Light and Lighting

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Street Lighting and Accidents

A GREAT deal of new street lighting of high standard is being installed up and down the country, yet there seems to be no abatement of total accidents on the roads month by month. This does not mean that improved street lighting is making no contribution to road safety, and there is evidence in an article we publish this month that—as it is reasonable to expect—better lighting is leading to a reduction in the night accident rate. There is a continual increase in road traffic and, in so far as the accident risk is proportional to traffic density, some increase in the number of accidents occurring both in daylight and at night is to be expected. On a number of recently relighted roads which have been studied there has, in fact, been an increase in the number of daylight personal-injury accidents, but relative to the change in daytime accidents those at night have been found to be no less than 35 per cent. fewer after the improvement of lighting than before. This decrease is statistically significant. What is also of great interest and importance is that the estimated monetary value of the accidents saved by re-lighting these roads is sufficient to cover the cost of the new installations. There is reason enough for gratification here, but still more when we bear in mind that which cannot be expressed numerically—the saving in human suffering.

Notes and News

I.E.S. Summer Meeting

It was announced some months ago that the next I.E.S. Summer Meeting will be held at Harrogate from May 8-11 next year. We have now been asked to announce that the headquarters will be at the Majestic Hotel, which will accommodate about 200 delegates; accommodation is also available at the Cairn Hydro, the Hotel St. George and at the Old Swan Hotel, all of which are near the Royal Hall where the meetings are to be held. Intending delegates are urged to make their hotel reservations as soon as possible—direct with the hotel, *not* with the I.E.S. office.

The provisional programme for the meeting is as follows :—

Tuesday

Afternoon.—Visits to Montague Burton, Ltd. (Leeds), J. J. L. and C. Peate (Guiseley), and Glass Bulbs, Ltd. (Harworth).

Evening.—Civic reception.

Wednesday

Morning.—Paper on Light and Colour, by J. W. Strange and H. Hewitt.

Afternoon.—Papers on Lighting of Small Factories, by J. S. McCulloch, and A Critical Analysis of Lighting Equipment and its Maintenance, by C. J. Veness and J. Mortimer Hawkins.

Evening.—Display of new lighting equipment.

Thursday

Morning.—Visits to Rowntrees Ltd. (York), Hailwood & Ackroyd (Morley), and J. Crawthra & Co. Ltd. (Bradford).

Afternoon. — Papers by Professor L. Schneider (Germany) and J. Havelka (Czechoslovakia).

Evening.—Dinner and Dance.

Friday

Morning.—Papers on Apparent Brightness of Light Sources, by W. R. Stevens and H. M. Ferguson, and Decorative Lighting, by D. W. Durrant.

Afternoon.—Annual general meeting.

The programme is an interesting and varied one and we shall be surprised if another attendance record is not set up. We would again remind you to book your hotel accommodation early.

Lighting Flexibility

A recent meeting of the Modular Society was devoted to the subject of "Lighting Systems and Dimensional Co-ordination." Organised jointly by the Society and the British Thomson-Houston Co., Ltd., the meeting discussed a number of questions, the most interesting of which was undoubtedly that concerned with "flexibility."

Mr. J. Hollings, of Gordon Buckle and Partners, consulting engineers, posed the problem of the large general office area "in which it is required to erect partitions on any of several lines at modular intervals." Said Mr. Hollings: "A lighting system and places for switching can be designed and the scheme arranged so that partitions can go up anywhere; but it is no use having Mr. Jones's office lighting controlled by switches in Mr. Smith's office."

A number of solutions were put forward: Mr. Bruce Martin, of the B.S.I., having condemned the wall switch by the door as obsolete and described conduit as "a menace," suggested that pull switches had certain advantages, although he pointed out that, when partitions were moved, the switch was not always on the right side of the door. He also mentioned "some kind of switchboard" as a possible solution.

Mr. M. Hartland Thomas, secretary of the Modular Society, suggested the use of low-voltage switches controlling the higher voltage lighting by means of a relay system. The wiring for the switches could then be in bell wire which need not be in conduit and could easily be removed. Mr. William Allen, of the Building Research Station, who took up this point, was of the opinion that it was not even necessary to conceal the wiring, provided it was not carried out objectionably.

Another solution put forward was an arrangement whereby there would be a network of two-pin sockets over every point where partitions might be placed. Wiring for the switches would be plugged into the sockets and taken through the hollow partition panels, while sockets not in use would be shorted out. Such an arrangement was rejected, however, by at least one speaker, on grounds of expense.

A "new" idea which emerged was that of doing away with switches altogether (except for master switches), by means of photo-sensitive cells and relays which automatically switch the lights on when the illumination level falls below a certain pre-determined figure. Such a system of control has in fact been available (from Radiovisor Parent, Ltd.) for many years. In large office buildings this system could lead to a considerable saving in electricity, for, just as thermostats save current by switching heaters off when they are not needed, the photo-senistive cells would switch off the lights when the clouds had passed over.

The American National Technical Conference

This year's National Technical Conference of the American I.E.S. was held from September 12 to 16 in Cleveland, Ohio. In addition to such distractions as a Futurama (?) party and a festive international outdoor dinner party (dancing in native costumes), as many as 35 papers were presented at the technical sessions. Although many of these papers will eventually be published in "Illuminating Engineering," and will subsequently appear in abstract form in this journal, it is of interest briefly to review at this stage the subjects which were discussed.

Of the two research papers, one has the intriguing title of "Footcandles for the Forgotten Man." This points out that when averaged data are used in the design of a lighting installation, then the needs of only 50 per cent. of the population are catered for. To satisfy the illumination requirements of a further 45 per cent. of the population, about three times the average illumination level is needed.

Of the three papers devoted to home lighting, one offers solutions to the home picture lighting problem which should prove of interest to recent correspondents to this journal. The street lighting papers include an analysis of the seeing factors involved in roadway lighting and their application to the design of street luminaires and a report of a conference on the problems of lighting tree-lined roads.

The papers on daylighting include one on the use of louvred acrylic plastic wall panels; and another which advocates a 4-ft.-high side window in school classrooms merely to ensure a view outdoors, the requisite level of indoor illumination being obtained solely by artificial lighting.

Papers on lighting application deal with such diverse subjects as the economics of lighting advertisement hoardings and the feasibility of lighting refrigerated spaces (0 deg. F. and lower) with fluorescent luminaires. Fluorescent lamps are featured by a paper on the effect of lamp wall temperature on operating characteristics, covering in particular the higher current ratings of the newer American lamps, and a paper describing the "stabilising" of halosphosphate phosphors to give a higher initial lumen output (4-8 per cent.) and an improvement in the lumen maintenance throughout lamp life (5-10 per cent.). The resultant overall increase in light production from a 40-watt lamp due to phosphor stabilising is claimed to be about 1,500,000 lumen hours.

The development of a series of infra-red lamps is reported which, by using quartz instead of glass for the tubular bulb, enables much higher intensities of radiant heat to be produced. A further paper on light sources will be of topical interest to those readers who keep abreast of their copies of the I.E.S. Transactions since it is a report by Destriau, the pioneer of electroluminescence, on the effect of various metal electrodes on the light/time curve of an electroluminescent cell.

Perhaps next year there will be a paper on the lighting of Futurama parties.

C. & G. Examination Results

The results of the City and Guilds of London Institute examinations in illuminating engineering held earlier in the year have just been announced and are as follows :—

Intermediate Grade

First Class.—O. Aiyedun, B. Cassidy, R. L. Gardner, R. McLagan, M. F. Oldham, J. C. Procter, A. R. M. Spalding, D. A. Spurgen, R. W. Taylor, M. Wood-Robinson.

Second Class.—N. Atkinson, F. M. Bonin, C. H. Dunkley, A. M. G. Gibson, J. Henry, D. M. Jamindar, B. P. Kelly, W. F. M. Langsworthy, K. H. W. Last, D. J. Lenthall, E. G. Maddock, G. H. Pantall, Jan Szahidewicz.

Final Grade (Papers 1 and 2)

First Class.—R. Croft, J. H. Howard, K. H. Ragsdale.

Second Class.—H. W. Archer, C. H. Bedwell, Miss E. A. Phillips Tingle, J. E. Robinson, J. F. Roper.

Final Grade (Papers 1 and 3)

First Class.—R. Croft, J. H. Howard, W. K. Lumsden, B. O. Matthews, M. W. Picton Pegg, K. H. Ragsdale, Miss J. L. Stewart.

Second Class.—H. W. Archer, A. R. Bean, P. K. Brighting, A. G. Free, N. P. Gripper, C. R. Mortimer, J. Stewart.

A.F.E. Meeting

The Association Française des Eclairagistes are now considering the venue of their next conference. It will certainly take place somewhere in the valley of the Loire, and probably at Tours. This area has been chosen because of the famous chateaux of the Loire, many of which are regularly floodlit or have become *châteaux parlant*. Many who heard, or have read, Jean Chappat's paper to the I.E.S. will have had their appetites whetted and will be glad of the opportunity of seeing these spectacles for themselves. The French meeting is always full of interest and is well worth attending by more than the usual few old faithfuls from this country who regularly take part in the proceedings. We will publish fuller details as they become available. The meeting will probably take place in the week beginning June 11, a few weeks after the I.E.S. Summer Meeting, thus enabling people to attend both.

A.P.L.E. Conference, Folkestone

Report on the proceedings of the recent annual conference of the Association of Public Lighting Engineers.

This year the A.P.L.E. held their annual conference at Folkestone from September 13 to 16, under the presidency of Mr. J. M. Waldram, a past president of the Illuminating Engineering Society. The meetings were held in the Leas Cliff Hall and the exhibition of lighting equipment was arranged in the adjacent Langhorne Gardens. The number of delegates this year, over 1,100, was a record for the Association, and as usual there were a number of visitors from countries overseas.

On Tuesday morning, after the annual general meeting of the Association, the conference was opened at 10 a.m. by His Worship the Mayor of Folkestone, Councillor T. L. E. Franks, J.P., C.C., who first referred to the fact that this was a return visit, the Association having visited Folkestone for its annual conference in 1937. He noted the growth in its numbers and influence during the past 18 years, and paid tribute to the work done by its members in improving the standard of street lighting in this country.

The retiring president, Mr. L. A. Doxey, after an expression of thanks to the Mayor, announced that the Council had conferred the distinction of honorary membership on Mr. H. C. Brown, who was retiring from the position of honorary treasurer after 25 years of devoted service. He then presented Mr. Brown with an illuminated address.

The next business was the induction of the new president, well described by Mr. Doxey as one who had not only a nation-wide but also a world-wide reputation for his work in the field of research in public lighting. Mr. Waldram was then invested with the president's chain of office and, after acknowledging the honour which the Association had conferred on him, he presented Mr. Doxey with a past president's badge and a certificate to serve as a memento of his year of office.

The Presidential Address

Mr. Waldram then delivered his presidential address, beginning with a reference to the fact that this was the first occasion on which the A.P.L.E. had elected as its president someone who was not a public lighting engineer. This action, he said, was not only a signal honour to himself but it was also a recognition of the fact that the job of public lighting involved a big team of people supporting the public lighting engineer. This idea that public lighting was an example of team work formed the theme of Mr. Waldram's address, and he illustrated it with an ingenious diagram showing the relationships between the many different bodies concerned, some administrative and policy-making, some investigatory, some responsible for the supply of energy, and some concerned with the development and manufacture of equipment.

First of all, however, came a reference to the traffic problem and to the contribution which the public lighting engineer could make towards its solution. Mr. Waldram emphasised that lighting could only be effective if it formed part of a well-considered and thorough plan for the road system as a whole. "Bad lighting," he said, "may make a good road dangerous or slow, but good lighting cannot make a bad road good." He concluded this section of his address with some figures indicating the magnitude of the task which faced the public lighting engineers of this country.

The Public Lighting Team

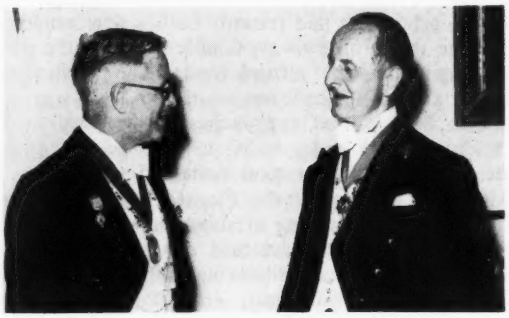
Returning to the main theme of the team work involved in public lighting, Mr. Waldram said that the public lighting engineer was a municipal officer responsible to his council and his job was to implement the policy decided, with his advice, by the council, acting usually through a lighting committee, and, on the financial side through a finance committee. The fact that the lighting could succeed only in so far as it was a co-ordinated plan for the roads meant that there should be very close co-operation between the lighting engineer and the city surveyor and perhaps also with the town planning committee and the police. It could not be too often emphasised that a major part of the installation was the street itself, especially the carriageway surface which could make or mar the whole result.

The best organisation had not yet been worked out, said Mr. Waldram. Though the design and carrying out of lighting, especially of local roads, should be in local hands, provided that they were sufficiently strengthened where necessary with technical advice and financial help, co-ordination of neighbouring urban and rural lighting schemes, particularly for traffic routes, was obviously essential.

Practice and Design

Turning next to the design side of public lighting, Mr. Waldram said that the lighting engineer's guides to good practice were the Codes prepared by the British Standards Institution. The Committee of that Institution responsible for the preparation of the Codes had been at work for many years and had now produced two workable and agreed documents couched in practical terms. Behind this practical guidance there was necessarily much good theory and fundamental research, and in this field the Road Research Laboratory, working

Mr. J. M. Waldram acknowledging his induction as president of the A.P.L.E.



Mr. Waldram, president A.P.L.E. and Mr. E. C. Lennox, president I.E.S. (Mr. Waldram wears a past-president's badge of the I.E.S. and Mr. Lennox a past-president's badge of the A.P.L.E.).

under the ægis of the Road Research Board, was doing very valuable work.

Mr. Waldram then passed on to speak of the special problems which public lighting presented to the Gas and Electricity Boards. A large town, he said, might have tens of thousands of lanterns scattered over the whole area, each separately connected to the Board's mains but using only one lamp. In many areas the Board had a part to play in the matter of control, either by the provision of additional conductors or by the installation of a system of ripple control, usually shared between public lighting and other electrical services requiring centralised control.

Modern Equipment

Finally came an interesting description of the part played by those members of the team responsible for the design and supply of the equipment used. Although the essentials of a street lighting lantern consisted of a lamp and some reflecting or refracting equipment, all small, light and cheap, yet the ancillary equipment necessary to enable these to function properly and efficiently on the street might weigh up to half a ton, cost a great deal of money and involve many different manufacturers and trades. Equipment used in public service had to be reliable in operation and safe even in emergencies. It was relied upon to operate out of doors in all weathers for years, often without proper overhaul.

Developments were stimulated by competition but were very costly. The most outstanding example was the range of electric discharge lamps now available, and only those in touch with lamp development could appreciate the magnitude of the research which went into a new lamp. It was not generally realised that the fluorescent lamp of to-day gave more than twice the light and had more than two and a half times the life of the first lamps of that type. Then there was the control gear inseparable from some lamps, starters, capacitors, radio interference suppressors and other items, all to be made to close tolerances with long life and reliable performance.

The lanterns, said Mr. Waldram, consisted of two main parts, the so-called "optikon" of refracting or reflecting elements, fabricated in glass or transparent plastic and called upon to exercise very rigid control of the light, and the metal parts which had to be resistant to corrosion and combine rigidity with lightness. Finally there were the column and bracket which were the biggest items in the unit and involved quite different kinds of engineering, the fabrication of steel tube and reinforced concrete. The address concluded with a tribute from Mr. Waldram to the skill and ingenuity of those on the manufacturing side of the job, and he expressed his keen satisfaction at being the first of their number to become President of the Association.

The address was illustrated with an ingenious version of the diagram referred to earlier, executed in fluorescent paints, and with a number of short colour films. At the conclusion, a vote of thanks was proposed by Mr. H. Carpenter and seconded by Mr. E. L. Allman, Borough Engineer of Folkestone.

Street Lighting Administration

In the afternoon Mr. Granville Berry, City Engineer of Coventry, and Mr. W. H. Shaw, the Lighting Engineer, gave a paper entitled "Local Authorities and Public Lighting" in which they discussed at length the problems of administrative control and finance, with particular reference to the urgent need for street lighting to be treated like other road improvements and to rank for a grant from the Exchequer. The present system of administration, they said, was quite out of date and they referred

to Lord Selkirk's statement in the House of Lords that there were far too many lighting authorities at the present time. The number was, they said, about 3,500, of whom more than half were rural district and parish councils whose financial resources were quite inadequate for the provision of lighting to satisfactory standards. They referred to a survey carried out recently by the Institution of Municipal Engineers. This indicated that in the areas of the 345 authorities included in the survey some form of lighting was provided on 90 per cent. of the roads, 37 per cent being by gas and 53 per cent. by electricity. The lighting rate was about 11d. in urban districts and municipal and county boroughs, 5.26d. in rural districts, and 7.27d. in the metropolitan boroughs. There were, it seemed, some 1,500,000 street lamps in the whole of Great Britain, costing local authorities £11 to £12 million per annum. The cost of bringing all lighting up to present-day standards might be estimated at some £5 million per annum, and this ought to be considered in relation to a probable reduction of some 20 per cent. in the accident rate.

A Comparison with Highway Maintenance

The authors then went on to compare the position as regards public lighting with that which existed as regards the maintenance and improvement of the highways themselves. Under the Local Government Act of 1929 the number of authorities responsible for highways was reduced to less than 150, most of them being counties or county boroughs. Municipal boroughs and urban districts retained control over unclassified roads. The authors thought that a similar arrangement would be quite satisfactory for public lighting. Similarly, just as major road improvements attracted a grant from public funds, so should street lighting and the A.P.L.E. had, in the last few months, suggested an arrangement of this kind.

Tariffs then came under consideration. The authors pointed out the great diversities in different parts of the country as regards both the charges made by Area Boards for bringing the service to the columns and the rates for the energy consumed. They attributed the general curtailment in street lighting after 11 p.m. to the need authorities felt to reduce the total cost of energy, having regard to the rates charged

Passing from administrative and financial matters the authors then gave a very interesting survey of the work and responsibilities of a lighting department in a large municipality. In addition to the maintenance of the street lighting the department was responsible for other forms of public lighting, such as that in subways. In his delivery of the paper Mr. Berry urged at some length, using many attractive colour slides, that lighting departments should greatly extend the practice of floodlighting the buildings and places of interest in a town, not only on festive occasions but at all times. Less orthodox was his account of the many duties, other than those connected with public lighting, undertaken by the lighting department in Coventry; in fact the department seemed to be responsible for everything electrical used by the Corporation, from domestic appliances in housing estates to tape recorders for recording Council proceedings. In this section of the paper the authors described the V.H.F. system used for communication with vehicles employed by the Corporation and urged that a V.H.F. band should be made available for the radio control of street lighting.

Tariffs Again

The discussion was a lively one and ranged over most of the topics raised in the paper. The opener, Mr N. L. Staniforth, urged that the matter of a grant from public funds should be settled one way or the other as quickly as possible; continued doubt as to the possibility of a grant would hold up schemes of improvement. Mr. J. Wilson expressed a fear that such a grant would involve more centralised control, depriving local authorities of their freedom in lighting matters.

Mr. A. E. Marchant and Mr. Eric Bates, respectively of the London and the Eastern Electricity Boards, took up the matter of tariffs. The latter pointed out that the cost of giving a service to a lighting column was high in comparison with the cost of the energy consumed, and in these circumstances it would be quite unfair to spread the cost of the service over the cost of energy to the general consumer.

Mr. H. V. Overfield gave an amusing example of what could occur under present administrative arrangements. Scarborough had recently built a new neighbourhood some three miles away, connection with the parent town being by means of a trunk road. The parish council in whose area lay a mile or so of this road was quite unable to light it, and approaches to the Ministry and to the county had so far failed to produce any solution to the problem, and the road remained unlit.

Mr. D. S. Young, of the City of London, put in a plea for the better lighting of subways, while Councillor Ireland, of Brighton, urged that there should be more co-operation between neighbouring authorities to achieve a greater degree of uniformity. Mr. W. Robinson tried to make the delegates' flesh creep with a gloomy prophecy of an imminent steep rise in the accident rate for pedestrians and cyclists.

In his reply, Mr. Granville Berry referred again to dusk-to-dawn lighting, and suggested a special tariff for the hours after 11 p.m. He did not fear that a grant would bring greater control from above; the system had operated quite satisfactorily in the case of highway improvements and there was no reason why it should not do so with public lighting.

A vote of thanks to the authors, proposed by Mr. E. C. Lennox, was carried by acclamation.

Social Events

The annual luncheon of the Association was held at the Hotel Metropole on Wednesday, September 14, when the principal guests were the Mayor and Mayoress of Folkestone, the Mayor and Mayoress of Dover and Dr. Walsh (president of the International Commission on Illumination). The joint toast of the Borough of Folkestone and the guests was proposed by Mr. H. Carpenter, the newly elected vice-president of the Association, who said how much the A.P.L.E. appreciated the welcome they had received and the help rendered by the corporation and its officials. He mentioned the large representation of the Association's badge executed with thousands of tiny plants in the carpet bed near the Leas Cliff Hall. The Mayor of Folkestone replied briefly and congratulated the Association on the excellence of its programme; he extended to it a very cordial invitation to hold another conference in Folkestone in the not too distant future. Dr. Walsh then proposed the toast of A.P.L.E. and its

president, saying that he was really speaking on behalf of the Member of Parliament for Folkestone., Sir Harry Mackeson, who was unfortunately prevented from being present but who had sent a message of good wishes. He expressed appreciation of the support which the A.P.L.E. had given to the work of both the National Illumination Committee and the International Commission on Illumination. The president, in reply, said that the Association was in a very flourishing state. There was a great deal of work for it to do, and he felt confident that it would give as good an account of itself in the future as it had done in the past.

After the luncheon, delegates and their ladies participated in excursions, visiting respectively the Fairfield Airport of Silver City Airways, the Dover Harbour Board's new car ferry terminal, and Dover Castle. On the Tuesday evening there was a reception by the Mayor and Mayoress at the Lees Cliff Hall, while on Thursday evening delegates and ladies attended a reception by the president and Mrs. Waldram.

The New Code

It will be remembered that the present Street Lighting Code, first issued three years ago, deals only with the lighting of traffic routes (Group A lighting). It is, in fact, only the first part of a complete Code for the lighting of all roads. The second part, dealing with the lighting of side roads (Group B lighting), has recently been completed and, although it is not yet available generally, the British Standards Institution arranged for advance copies to be supplied to all the delegates at Folkestone, and a discussion on this document was opened on the Thursday morning by Dr. J. W. T. Walsh.

He said that in Group B lighting the objects to be served were generally much the same as in the case of Group A lighting, but their relative importance was different. The emphasis shifted from the needs of the driver, which were paramount in Group A lighting, to those of the pedestrian and of local residents, and he drew attention to the fact that in the new part of the Code the object mentioned first was " to light the footways adequately and to define the kerbs clearly to both pedestrians and vehicle drivers." The lighting of the carriageway came third in the list.

Next, Dr. Walsh referred to the diversity of character of the roads included. This, he said, was one of the main difficulties which had faced the drafting committee at the outset, and he described the exploratory work which had led to the decision to make two sub-divisions, Group B1 and Group B2 respectively. This sub-division was purely and simply concerned with the kind of lighting considered most appropriate for different kinds of road; the standard of Group B1 was not necessarily higher than that of Group B2 or vice versa. Generally speaking, the roads for which Group B1 lighting was considered best were roads in which the distance between the building faces was frequently less than twice the width of the carriageway and the presence of trees was the exception rather than the rule. Group B2 lighting, on the other hand, was suitable for the many suburban residential roads, with deep front gardens and wide footways, where the distance between the houses and the kerb might well be greater than the kerb-to-kerb distance and where trees were frequently met with. To help explain the distinction between the two groups, photographs of typical roads falling within each had been included in the Code. Group B1 lighting was essentially more directional than Group B2, and a certain amount of asymmetry was suggested in the former case, while in the latter a symmetrical distribution was advocated as light was required not only up and down the road but towards the centre and sides as well.

An Intermediate Standard of Lighting

It has often been suggested that a standard of lighting intermediate between Group A and Group B should be recognised. This matter, said Dr. Walsh, had been very carefully considered by the committee, who had finally decided against it. They felt that the recognition of such a standard would result in its being provided on roads which really ought to have Group A lighting. With regard to the oft-expressed desire to have an intermediate mounting height (the Code specifies 25 ft. for Group A and 15 ft. for Group B), Dr. Walsh said that after very full consideration of the arguments advanced in favour of this suggestion, the committee had come to the conclusion that the disadvantages outweighed the advantages. Turning to the subject of glare, Dr. Walsh drew attention to the fact that the provisions in this part of the Code were more severe than those laid down in Part I, and he felt it would be agreed that this was justified, having regard to the generally lower level of illumination. A medium-angle beam distribution was therefore to be preferred to a high-angle beam.

Tot homines, quot sententiae

Opening the discussion, Mr. J. W. Christie, of the Road Research Laboratory, said that he felt it was wrong to restrict the mounting height to 16 ft. (15 ft. with a 1-ft. tolerance) because this had been recommended by the Departmental Committee 18 years ago. There had been great advances in our knowledge of street lighting, and he thought that the illumination of the carriageway ought to have received more attention, especially in roads which were intermediate in character between traffic routes and purely residential roads.

Mr. H. Carpenter suggested not an intermediate mounting height but an extension of the tolerance permitted to, say, 3 ft. This would permit of mounting at 18 ft., so that where desirable the lanterns could be carried out over the carriageway. He and a number of subsequent speakers said that the lower limit of luminous flux output, *viz.*, 600 lumens per 100 ft. of road, was too low.

Mr. F. J. Cave referred to the extensive relighting programme at present in progress at Northampton, and said that experiments had been carried out on lighting to an intermediate standard. These had shown that such lighting was not satisfactory. He mentioned that in some installations the mounting height was at the lower permissible limit of 13 ft., the spacings being 90 to 110 ft. Mr. C. C. Smith endorsed Mr. Cave's condemnation of an intermediate standard; for simplicity and consequent ease of maintenance it was desirable that there should be two standards only.

There was, however, strong advocacy of the intermediate standard from Mr. H. Cork, of Manchester, who said that among the Group B roads there were a number of bus routes, and to a driver whose eye was 7 ft. above the roadway a 15 ft. mounting height could give rise to considerable glare. He felt the committee had not paid

sufficient attention to the financial aspect of the matter. The cost of providing Group A lighting on the many miles of minor traffic routes would be enormous, and in the absence of an intermediate standard these would be provided only with Group B lighting.

Mr. Pulvermacher, of the South Wales Electricity Board, and Mr. J. Clapp, of Camberwell, both raised the subject of streets in which the present spacing was 150 ft. To change to something like 110 ft. would be a most costly matter, and to use an intermediate mounting height would be a much more practicable way of improving the lighting in such streets.

The use of dipped headlights in side roads was advocated by Mr. J. G. Holmes, while Mr. Ward, of Glasgow, and Mr. C. Harper, of Barking, both urged the importance of raising the standard of lighting on Group B roads.

In his reply, Dr. Walsh said that he felt the discussion had, on the whole, endorsed the committee's views both as regards the intermediate standard and the mounting height. He emphasised that the document was a Code of Practice to help and guide the public lighting engineer in his efforts to improve the lighting of roads other than traffic routes. It was not a rigid specification.

A vote of thanks, proposed by Mr. H. Pryce-Jones, closed the meeting.

Tree-lined Roads

In the afternoon there was a very full meeting to listen to Mr. H. M. Ferguson, who presented the paper of which he was joint author with Mr. W. R. Stevens and which was entitled "The Lighting of Tree-lined Roads." No one, said the authors, liked to cut down a tree, and they began with a description of the problem which in other countries frequently presented an even more forbidding aspect than here. Severe lopping was sometimes necessary, and if this was done skilfully the results, both as regards the lighting and the trees, were often very satisfactory. The only alternative was to place the lights in such a position that the inevitable shadows produced by the trees would be as harmless as possible.

Dealing first with traffic routes, the authors said that the mounting should be such that the trees did not intercept light between the vertical and 5 deg. below the horizontal for all directions, making an azimuth angle of less than 10 deg. with the kerb line. With a cut-off system the 5 deg. could be increased to 15 deg., but in practice such a system was generally arranged with central suspension. On some traffic routes a mounting height of 20 ft. with a corresponding reduction in spacing was sometimes advantageous.

Turning to roads other than traffic routes, the authors described a series of investigations they had carried out, using mock-up lanterns giving some quite unconventional types of light distribution. These had four peaks instead of two, each peak occurring at an angle, in azimuth, of about 30 deg. from the kerb line. It was soon found that an important factor in securing a good result on the road was the distribution in planes passing through the source and through lines on the roadway parallel to the kerb line and at various distances from it. Such a plane was defined by the ratio of b, the distance between the kerb and the line of intersection with the roadway, to h, the mounting height of the lamp. Trials were made with lanterns giving various types of distribution in the planes for which $b/h = 1$ and $b/h = 2$. In a final test a comparison was made between the effects produced by the experimental lanterns and that given by the ordinary Group B sodium lanterns, and it was the general opinion that the experimental lanterns with 150-watt pearl GLS lamps gave a better result than any conventional installation with the same light output.

Although it was clear that a good deal of further work remained to be done, the authors put down some suggestions for the lighting of tree-lined Group B roads, assuming the road surface to be rough and light in tone. These suggestions may be summarised as follows :—

(a) The general form of the distribution should have four peaks, each "toed" away from the axial direction by some 25 deg., the maximum intensities being at some 70 to 75 deg. from the downward vertical.

(b) The polar curves in planes for which $b/h = 1$ and $b/h = 2$ (and possibly also $b/h = 3$) should be substantially flat-bottomed up to the region of maximum intensity.

(c) The directional intensity ratio (ratio of the maximum to the average intensity below the horizontal) should not exceed 3.

(d) If the buildings are relatively close to the road the distribution may, with advantage, be unsymmetrical about the axial direction, with more light going towards the road than towards the houses. In this case the directional intensity ratio might perhaps be somewhat increased.

(e) It is sometimes found that mounting heights below 15 ft. give the best results, but generally the higher the mounting the better. Similarly, although a spacing of 120 ft. staggered has been found satisfactory on a tree-lined road, a closer spacing is recommended.

(f) The minimum luminous output recommended is 750 lumens per 100 ft., although tolerable results have been obtained with outputs as low as 450 lumens per 100 ft.

Trees—or Lighting?

The discussion was opened by Mr. G. C. Small, who wanted to know why the authors had not experimented with fluorescent lamps, and this point was also taken up by the next speaker, Mr. Macdonald, who said that the use of these lamps gave a very pleasing effect, which was probably due, at least in part, to reflection from the foliage. Mr. Small castigated the authors for using values of luminous output so close to the lower permissible limit. He showed slides of a number of very successful installations on tree-lined traffic routes. These were mostly of systems in which the lanterns were mounted more or less centrally either by means of long bracket arms or by the use of columns on a central reservation. Mr. Macdonald expressed a strong dislike for equipment which depended on precise optical control of the light from the lamp.

Dr. J. W. T. Walsh hoped that the paper would result in more experimentation by public lighting engineers or others. He suggested trials with columns bearing a pair of conventional lanterns separated by a few feet. Each one of the pair would provide two of the peaks, one on the house side and one on the road side. With the range of non-axial asymmetric distributions now available it might be possible in this way to discover the most suitable distribution for a road of any given width lit by lamps at any convenient spacing.

Some interesting work carried out at Torquay was described by Mr. L. Foale, who said that in certain roads

carrying an appreciable amount of by-pass traffic the lanterns were mounted at about 16 ft. on brackets attached to the trees themselves, the cables being run up the trunks. The effect was, on the whole, satisfactory, although in certain cases the lighting of the footway left something to be desired.

Mr. Osgood, of Luton, started a sharp controversy when he said that if trees were in the way of the street lighting they should be cut down. Mr. L. A. Doxey strongly disagreed and declared that it was the public lighting engineer's task to overcome difficulties of this kind. The president poured oil on the (faintly) troubled waters by pointing out that both trees and street lighting were amenities; neither should be considered as paramount, and the best arrangement possible in each particular case should be adopted.

Mr. W. R. Stevens replied to the discussion and showed a picture of the team and some part of the very varied collection of apparatus used in the trials. Fluorescent, he said, had been included, although there was no mention of it in the paper. He deprecated Mr. Macdonald's remarks about optical control and said this was widely used to-day with perfectly satisfactory results.

After the reply, which concluded with a plea for further experiment, Mr. C. C. Smith proposed a vote of thanks to the authors, and this was carried by acclamation.

Central Control

On Friday morning Mr. J. F. Mackenzie, of the Automatic Telephone and Electric Company, Ltd., gave a very interesting paper on the centralised control of street lighting. A paper on methods of control seems to be almost a hardy annual with the A.P.L.E., but Mr. Mackenzie found plenty to say that was of interest to the delegates. The particular virtue of central control which he stressed was its flexibility. Earlier methods, he said, did not offer this facility, with the result that public lighting engineers generally did not appreciate to the full its real advantages. Possibly this was one reason why the system was not as widely adopted as its advantages would seem to justify. No doubt, however, a more potent factor was cost and the economic brake which was inevitably applied to such new developments.

The next point taken up was the degree of centralisation appropriate in any particular set of circumstances; there might be fully centralised control of a whole area from a single point, or alternatively each sub-station might have its controller for the area it served.

Methods of Control

The various methods used were then described in some detail. "Fifth wire" control could only be installed when the power distribution system was being put in and the same thing applied to pilot-wire control, although to a less extent because a light pilot wire could sometimes be run on existing overhead supports. There were a number of different systems based on the injection of a signal into the supply network. This signal could be D.C. or A.C. The former could not negotiate the power transformers and therefore had to be applied at sub-stations and fully centralised control was out of the question, whereas an A.C. signal could be applied either at the sub-station or centrally.

On the D.C. system, said Mr. Mackenzie, the signal was derived from a 6-volt battery put in series with the neutral and was filtered out by a choke in series with the relay. The direct current passing through this choke saturated the iron and so reduced the impedance to the A.C. and the increased alternating current together with the D.C. signal operated the relay.

There were several A.C. systems in which the signal injected into the supply was picked up by some device tuned to a particular frequency. An earlier system of this kind, now little used, depended on a reed relay which, when the injected signal was of the appropriate frequency, was set into vibration and operated a mercury switch through a gear train. Ripple control by means of an A.C. signal at voice frequency could be applied in two ways. In one of these, two (or sometimes three) signals were needed for each switching operation. The first started a synchronous "clock" motor in each local switching relay. The second signal performed the actual switching operation and, by means of a selector drum, the nature of this operation varied according to the time interval between the two signals.

The second system, usually known as the "rhythmic pulse" system, depended on the injection of a train of impulses of given periodicity. The relays had oscillating members critically adjusted to respond to a certain periodicity and by altering the rhythm of the control signal the corresponding relays could be operated. Mr. Mackenzie said that the extreme simplicity of the rhythmic pulse relay, in which only two moving parts were involved at each operation, made it very attractive.

Radio Control

The final section of the paper dealt with a subject which had already been touched upon by Mr. Granville Berry and Mr. Shaw in their paper on Tuesday afternoon, *viz.*, the direct control of street lamps by radio. Mr. Mackenzie pointed out that radio control schemes quite analogous to the control of street lighting were already in operation. In one of these the rhythmic pulse principle of selection had been applied to the radio control of the lighting and other services in a lighthouse, the control point being on shore and the lighthouse on a rock in the sea. In another case the timing of traffic signals was controlled by radio. It seemed probable that initially the system would be applied to the central control of sub-station units. To add force to this remark, Mr. Mackenzie, at the end of his paper, gave a demonstration in which radio control, with a frequency of 85.875 megacycles, was used to actuate sub-station injection plant operating at 850 cycles and so to switch on or off either of two light sources.

Mr. H. Lloyd-Williams, of the London Electricity Board, opened the discussion by endorsing the author's remarks concerning the value of the flexibility afforded by centralised control. He pointed out that sub-station control became more costly as the load in an area increased, for this meant that each sub-station served fewer and fewer street lamps.

The importance of good maintenance of the injection equipment was stressed by Mr. F. Akister, of the East Midlands Electricity Board, while Mr. E. P. Burdett, of the Eastern Board, thought that ripple control was often only practicable if it could be applied to the control of other services in addition to street lighting.

Mr. L. A. Doxey mentioned an aspect of centralised control which, he said, interested public lighting engineers particularly. This was the relation between the supply

authority and the lighting department, which was naturally anxious that the control of the street lighting should not pass out of its hands because the apparatus had to be located at the sub-station. He described how matters had been arranged to everyone's satisfaction when Leeds adopted ripple control. A multicore cable was run from the lighting department to the controller in the sub-station and through this the department had complete control of the lighting without there being any question of access to the supply authority's premises.

The president quoted a series of questions which he always asked when any new system of control was advocated, and he inquired whether the flexibility claimed for the centralised control was in fact made use of. Mr. Mackenzie, in his reply, gave some instances in which it had been found valuable and then, taking up a point raised by Mr. Granville Berry, he said that under present conditions the cost of radio control would be considerably higher than that of ripple control. The meeting concluded with a vote of thanks to the author proposed by Mr. N. Axford.

Au Revoir!

Shortly after the conclusion of the final technical session there was a short meeting at which the conference was officially closed by a speech from the president in which he thanked all those who had contributed to its success. He mentioned, too, that the outstanding feature of the meetings had been the extent to which the lighting of so-called minor roads had received attention. Mr. Doxey then proposed and Mr. Boydell seconded a vote of thanks to the president which was received with prolonged applause.

So ended a conference which many of those present considered to be of a standard even higher than that of any of its predecessors. Next year the Association goes to that home of "illuminations" (and of the vice-president, Mr. H. Carpenter), Blackpool.

Display of Street Lighting Equipment

Exhibits at the A.P.L.E. Exhibition

AEROPLASTICS, LTD. (the Plastic Division of The Fairey Aviation Co., Ltd.) showed their "Kyle" and "Carrick" lanterns which were introduced for the first time last year. The "Kyle" is for Group B lighting and is suitable for 45/60-watt sodium lamps; the "Carrick" is for Group A lighting and is suitable for 85- or 140-watt sodium lamps.

AUTOMATIC LIGHT CONTROLLING CO., LTD. (known for over 60 years for their "Gunfire" controller for gas street lighting) showed a complete range of synchronous, electrically wound with spring reserve, and clockwork-driven time switches with switching capacities from 20 amp. single-pole quick break, air break to 50 amp. Triple pole hermetically sealed mercury to metal contacts and a range of cast iron aluminium and pressed steel boxes were also shown.

THE AUTOMATIC TELEPHONE AND ELECTRIC CO. exhibited a working demonstration of their new pedestrian-actuated traffic signal. The new signals have been designed in an effort to end unnecessary hold-ups, which at present hamper both pedestrians and motorists at many busy zebra-crossings. Cheaper than previous signals of this type, it incorporates a device to prevent abuse of the button controller. If brought into use too frequently a prearranged timing sequence comes into force, which gives both sets of road users a fair share of right-of-way. At times when there are no pedestrians waiting to cross, the green signal will remain with the road traffic, thus ensuring that there are no unnecessary hold-ups to motorists.

THE BENJAMIN ELECTRIC, LTD. showed the prototypes of some new fittings. These included a new pole-type mounting unit known as the "Mushroom" fitting which has been installed in the Embankment Gardens, South Bank Festival Site, etc., the new unit being designed to give wider distribution of light and for a greater range of lamps. It has a white top reflector and white opal globe which is dust and insect proof. The fitting is suitable for use in public gardens and parks, promenades, drives, forecourts of public buildings, boulevards, etc.

BERGO, LTD. showed a comprehensive display of bollards and floodlighting fittings for signs. Also shown were unbreakable polythene globes for flashing beacons and steel columns for Group B lighting.

BRIGHT, SON AND CO. (CLERKENWELL), LTD. demonstrated their repair service for electric time switches and gas controllers. This firm now has a collection and delivery service which is available in London, Leeds, Bimingham, Bradford, Manchester and Liverpool, thereby saving engineers in those areas expensive packing and transport charges and ensuring a more speedy service.

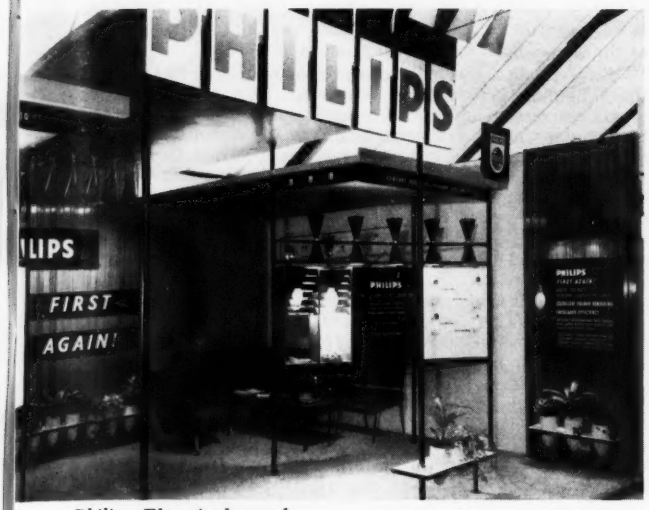
THE BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION again stressed on their stand the case for better street lighting as an important factor in the reduction of night accidents. In substantiation of their claim they quoted the experience of the County Borough of Northampton.

In 1951 Northampton commenced a re-lighting programme involving the replacement of the lighting of all main roads by fluorescent lighting to full Group A standard, and all other streets by tungsten filament lamps to Group B standards. This project is of interest because it embraces the re-lighting of a whole town with two forms of lighting only—one for main roads and one for other roads—and because the estimated cost of the complete scheme will not involve any significant increase in the rates.

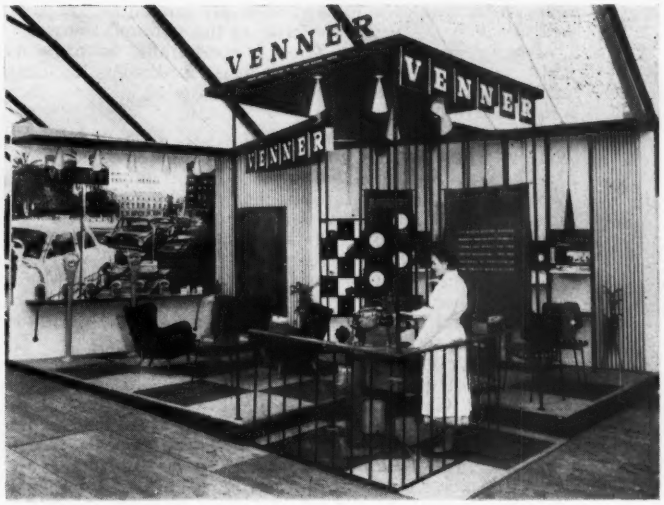
To date 50 per cent. of the re-lighting scheme has been completed, but the results are very revealing. The following table shows the percentage of accidents and casualties occurring at night in Northampton in the months of October and September:—

	1949/50 Per cent.	1953/54 Per cent.
All accidents	21.5	17.5
Accidents involving casualties	20	17.5
Killed and seriously injured	27.5	26.5
Total casualties	20	18

These figures show a *decline* in Northampton of 1 per



Philips Electrical stand.

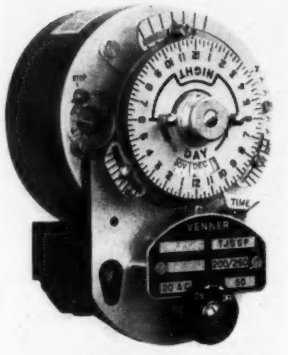


Venner stand.

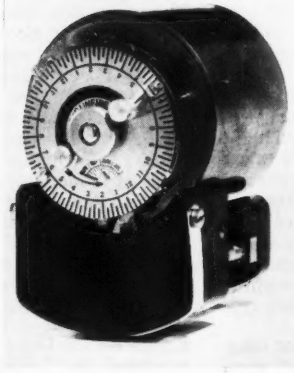
Sangamo type SSC switch

Horstmann type Q switch.

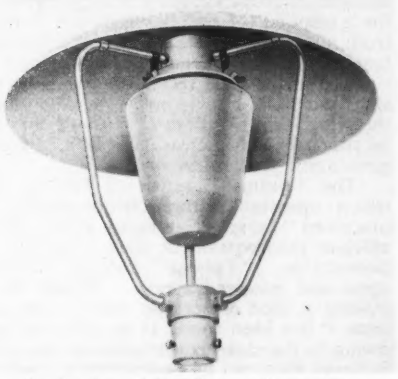
Bright, Son & Co. stand.



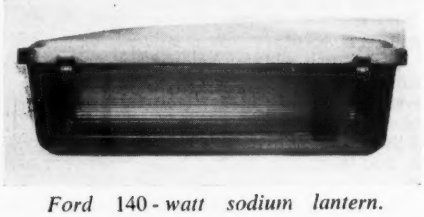
Venner type TJSSP switch.



A "Gunfire" controller.



Benjamin "Mushroom" fitting.



Ford 140-watt sodium lantern.

cent. in the case of killed and seriously injured as compared with *an increase of 2.5 per cent.* in the national average.

Despite the general increase in road traffic density since 1949, which is reflected by an increase in daylight accidents in Northampton, the night-time accidents of all types show a decrease of 22 per cent.

THE BRITISH THOMSON-HOUSTON CO., LTD., exhibited a wide selection of their current range of lanterns.

The selection included a new 2-ft. lantern mounting two 40-watt fluorescent lamps, suitable for Group B road lighting. Of similar construction to the "Amber," the new lantern comprises a corrosion resistant cast silicon aluminium alloy canopy with a hinged single-piece "Perspex" bowl. The two lamps are mounted one above the other and their output is controlled by an aluminium reflector and by "Perspex" refractor plates sealed to the bowl, the remainder of which has a slightly diffusing finish.

Also prominently featured was a display emphasising the weatherproof qualities of the "Sapphire" mercury reflector lantern for Group A lighting.

Samples of many of the Mazda lamps suitable for street lighting purposes were shown, among them the prototype of two new lamps anticipated by B.T.H., a 250-watt M.B.F./U. lamp and a sodium lamp with an integrated thermal jacket. A unit comparing the colour rendition of M.B. and M.B.F. lamps was also displayed

B.T.H. concrete columns were shown in the outdoor display.

CONCRETE UTILITIES, LTD., exhibited a selection of their range of Group A and B concrete lighting columns. Since the 1954 A.P.L.E. Conference several new designs have been marketed including the "Highway" for Group A and the "Byway" for Group B lighting. In most cases the lanterns exhibited with the columns were the new "Phosware" designs, supplied by Phosco, Ltd., of Ware. These lanterns were designed to fit the concrete columns, thus creating a complete unit of elegance and efficiency. The indoor display included illuminated scale models of a selection of columns and photographs of recent installations including a model of the "Highway X" with the proposed "Phosware" 3/80-watt horizontal fluorescent lantern.

THE CROMPTON PARKINSON, LTD., stand was devoted entirely to the new Crompton mercury vapour discharge lamp. The company claims that this lamp with its vastly improved construction—which eliminates the somewhat complex and vulnerable arrangement of springs and clips commonly associated with this class of lamp—yields a higher standard of maintained efficiency and greatly increased mechanical strength.

THE ENGINEERING AND LIGHTING EQUIPMENT CO., LTD., displayed a range of their lanterns. During the last year this firm has acquired a die cast foundry and has introduced plastics moulding and machining plants thus bringing under its own control the production of a considerable proportion of the components which make up street lighting fittings.

FALK, STADELMANN AND CO., LTD., displayed street lighting lanterns for use with tungsten filament, sodium and high pressure mercury vapour discharge lamps, all of which, with the exception of one lantern, are constructed throughout from non-ferrous metals. A new general purpose open type lantern for tungsten lamps was included.

Holophane glass refractors are used in lanterns for tungsten and H.P.M.V. lamps. As a protection against stone throwing, the "Wellesley" lantern for Group B roads can be supplied with a clear "Perspex" outer globe enclosing a glass dome type refractor.

The "Fulmar" range of lanterns for sodium lamps, which operate at lower temperatures, allows the use of machined "Perspex" refractor plates, which are rather more efficient than equivalent glass refractors and are almost indestructible. "Fulmar" sodium lanterns are available in open and enclosed types. Whilst the enclosed type of lantern is used extensively with a view to ease of maintenance, it has been found in practice during recent years that, owing to the clean construction of the open type "Fulmar" lanterns, they can be maintained as easily as, or easier than, the enclosed types, even in the most densely populated industrial areas where the worst air pollution prevails. The use of an open type lantern means a considerable reduction in cost and this type is more robust and durable particularly as the use of gaskets and fasteners is obviated.

A. C. FORD displayed a comprehensive range of Group B street lighting lanterns and brackets. This firm specialises in gas conversion units with integral spigot caps surmounted by tubular steel swan-neck brackets of various mounting heights. The size of control gear boxes varied from small units for the accommodation of double pole fuses to large ones for housing 125-watt mercury vapour gear and time switch.

A range of Class B open and enclosed type lanterns was displayed, each type being fitted with symmetric or asymmetric dome refractors. The enclosed lanterns can be fitted with either glass or perspex globes. A special lantern was the AC.424. This comprises a cast silicon aluminium body, fitted with a single piece bowl refractor, which has a perfectly smooth exterior, the light distribution prisms being cut on the interior surface.

All the above type lanterns were suitable for 100/200-watt tungsten filament lamps and 80/125-watt mercury vapour lamps.

The 140-watt sodium lantern Type AC.480 suitable for Group A roads which was displayed is the first of a range of sodium lanterns to be manufactured by this firm. It comprises a silicon aluminium body, fitted with an anodised aluminium reflector. The "Perspex" enclosing bowl is hinged on the side and fastened by means of quick action toggle clips.

A range of wall and pole mounting brackets and boxes completed the items exhibited.

THE FORD MOTOR CO., LTD., showed a 25-ft. four stage tower wagon and lorries carrying syphon emptying equipment made by Allan Taylor (Engineers), Ltd.

FRANCO TRAFFIC SIGNS, LTD., concentrated all their exhibits in their Outdoor display, in an effort to make this popular feature of past Exhibitions bigger and better than ever before.

Their highly successful bollard No. 4/E (included by the Council of Industrial Design in Design Review) was well to the fore.

Another noteworthy exhibit was the "Exlite type III" external lighting fitting for traffic signs. The streamlined design, though most attractive in appearance, has a severely practical function. By bringing the lamps and the large lamp aperture into just the right position in relation to the face of the sign, the entire area is brightly and evenly illuminated. Light is also directed on to the surmounting symbol through another aperture in the top of the fitting.

THE GAS COUNCIL at their stand had available specialists in street lighting to answer the questions of visitors. There was a supporting display of the latest type of gas lighting units and other equipment for use in conjunction with these units. Information was available on the economic advantages of modernising existing lamp standards by the addition of up-to-date lanterns.

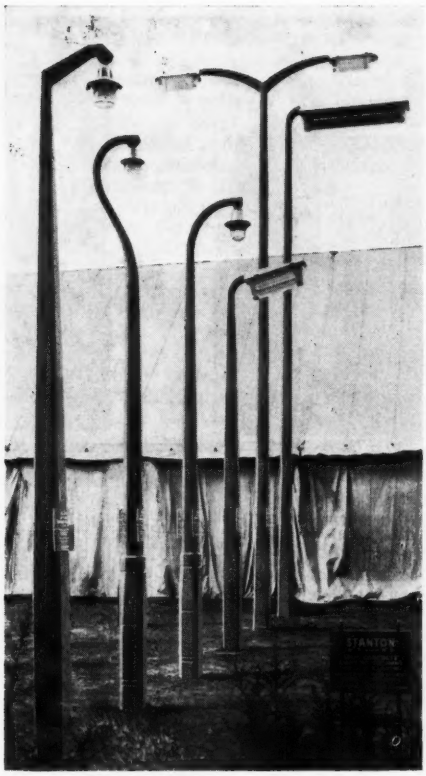
THE GENERAL ELECTRIC CO., LTD., showed two new injection-moulded refractor bowls for side road lighting and a range of new street lighting lanterns will be shown.

The G.E.C. is the first company to produce a plastic, one-piece refractor bowl controlling light in the horizontal and vertical planes. The first of the new bowls exhibited is known as the G.E.C. Z.6708 "Plastifractor." It is injection moulded in "Diakon," a moulding powder chemically identical with "Perspex." The bowl has a non-axial, asymmetric distribution for side street lighting. Particular attention has been devoted to achieving an attractive appearance when the lantern is lighted.

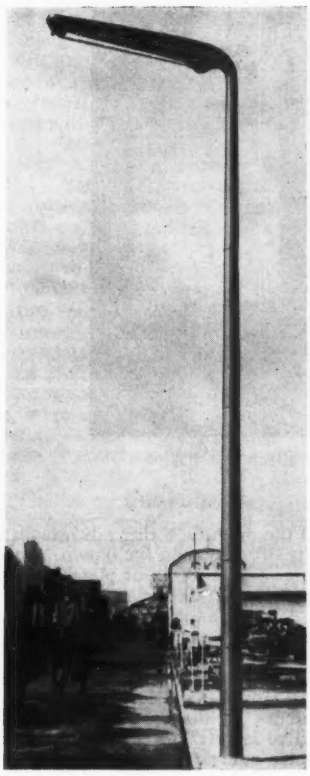
The method of manufacture ensures a high degree of repetitional accuracy, more efficient light control because of the high finish obtainable on the prisms, great impact resistance and light weight. The non-axial distribution is obtained by vertical prisms on the outside of the bowl and horizontal prisms on the inside. The method of construction and the material used will help to reduce breakages in transport and handling and, consequently, reduce maintenance costs.

The second new development was an injection moulded refractor bowl for side road sodium lanterns. It embodies

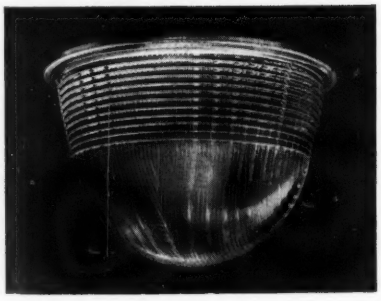
Concrete Utilities "Highway X" column.



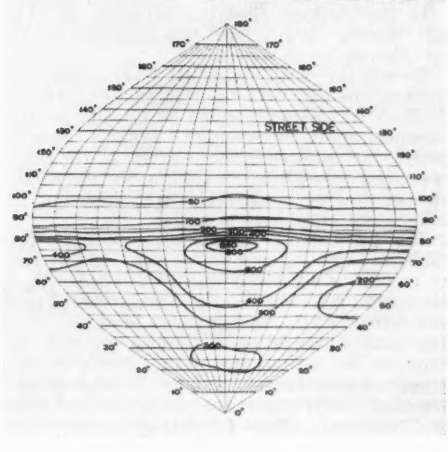
Group of Stanton columns.



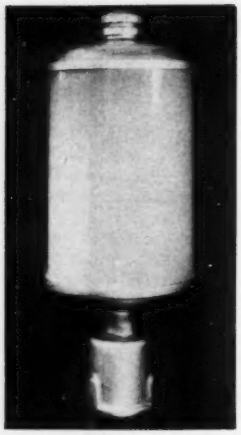
Poles column with "Kuwait" lantern.



Holophane refractor for Group B roads. Right—iso-candela diagram using 200-watt tungsten lamp.



Megatron type C5 street lighting meter.



Revo C14474 lantern.

Franco 4/E bollard.

Display of Gowshall bollards, etc.

all the manufacturing advantages of the " Plastifractor " and it is stronger than the blown " Perspex " bowl which it supersedes. The refractor plates are recessed on the inside of the bowl to facilitate cleaning, and the bowl presents an attractive appearance by night and day.

Three new multi-lamp hot cathode fluorescent lanterns were displayed. They are the " Three-Eighty," the " Vertical Four-Eighty," and the " Four-Forty." The " Three-Eighty " has a new body design incorporating concealed hinges and catches holding a one-piece " Perspex " enclosure, with sealed-in refractor plates controlling the light. The lantern, which is arranged for cantilever mounting, houses three 5-ft. 80-watt lamps. The new four-lamp vertical fluorescent lantern is for main thoroughfares, city squares and all situations which demand a design which will harmonise with the surrounding architecture. It houses four 5-ft. 80-watt lamps. The new " Four-Forty " lantern is intended primarily for lighting side roads, but the design has numerous applications in the field of decorative lighting. The lantern houses four 4-ft. 40-watt lamps.

A wide range of other street lighting lanterns, equipment and lamps was also shown.

In the outdoor display a selection of G.E.C. " Altus " and " Brevis " pre-stressed-plus concrete columns for main and side roads was shown.

GOWSHALL, LTD., displayed a completely new Guardpost (bollard), the new G55 " Smoothline " Guardpost, the design of which was made possible by revision to the Ministry of Transport and Civil Aviation " bollard " specification. Previously, this allowed a width of 13 in. for the " Keep Left " frame, but only 12 in. (maximum) for the width of the body; this can now be 13 in. The G55 dispenses with any components not absolutely essential.

For the external illumination of signs the well-known " Signlite " lighting unit was shown. It was designed to meet the recommendations of the 1944 Traffic Sign Report, and subsequent guidance by the Ministry of Transport ensures performance well in keeping with limits for average illumination, peak illumination and ratio between maximum and minimum for various sign sizes. Many of the new London through signposting assemblies, incorporating rigid P.V.C. pannelled construction, are adequately and evenly lighted by the " Signlite." Other exhibits included easily and quickly installed cast iron island sites—centre island refuge lighting and other columns—" Beacon " assemblies—and illuminated mandatory and warning signs.

HOLOPHANE, LTD., showed new designs to their existing range of Group B refractors designed to meet the desire to ratify new recommendations for the lighting of Group B roads, with a need to discriminate between narrow roads and the broader thoroughfares with wide grass verges and deep gardens.

These included type B1 Dome and Bowl Refractors designed for application in narrow and medium width Group B roads (Refractor Nos. 2/4116-B1, Single Piece Dome; 2/4125-B1, Single Piece Bowl); and type B2 Dome and Bowl Refractors for residential roads with wide grass verges and deep gardens (Refractor Nos. 2/4116-B2, Single Piece Dome; 2/4125-B2, Single Piece Bowl). The new refractors, although additional to the present range, have the same fixing arrangements and identical light centre positions, and are therefore immediately interchangeable in existing lanterns designed to embody these types of refractors. The refractors are of single piece design, and are suitable for G.L.S. filament lamps up to 200-watt, for mercury discharge and fluorescent lamps of 80- and 125-watt rating, and for blended lamps of 160- and 200-watt rating.

Other new products included the new " Lumifractor " (type 2/4117) which is a simplified and inexpensive application of the popular single piece dome refractor 2/4116 for Group B installations. The design embodies a glass canopy integral with the refractor, with quick action spring attachment to a weathershed cast aluminium boss which carries the lampholder mounting and provides ¾-in. B.S.P. top entry. This development is a departure from the traditional lantern design and offers a pleasing functional appearance with established standards of performance.

Other well-established lanterns and prismatic refractors were also displayed.

THE HORSTMANN GEAR CO., LTD., showed a comprehensive range of their well-known Gas Controllers and Comets for the automatic control and ignition of gas lit street lamps, and of their electric time switches.

It is always a problem in these difficult days for street lighting engineers to ensure that their gas lit street lighting is completely up to date and efficiently controlled without incurring heavy expenditure and Horstmann Gas Controllers and Comets go a long way towards solving this problem. They are well known for their reliability and for the economies which can be effected by their use, and more and more public lighting authorities are taking advantage of these facts.

The display of electric time switches included a comprehensive range of hand wound models (15- and 40-day run), synchronous models and electrically wound models with or without spring reserve as required.

THE IMPERIAL CHEMICAL INDUSTRIES, LTD., stand was devoted to a Plastics Division display which emphasised the value of " Diakon " acrylic moulding powder in the production of new types of street lighting lanterns and lighting components. " Diakon " is chemically akin to, and has many properties in common with, " Perspex " acrylic sheet (which was also displayed). Weather resistance and dimensional stability of " Diakon " are very good, so that mouldings do not dull, craze or warp. " Diakon " is most suitable for use in injection moulding processes, which enable manufacturers to mass-produce units of high technical quality at an economic price. It has already become an

accepted material for such components as lamp lenses, trafficators, motor-car rear light covers and lighting display units.

R. A. LISTER AND CO., LTD., showed their telescopic tower ladder truck which is mounted on pneumatic tyred wheels and has a road speed of approximately 8 m.p.h.

MEGATRON, LTD., showed selenium photo-electric cells of the barrier layer type and a range of their cosine-corrected light-meters. The latest development in the latter is the type C5 street lighting meter designed in conjunction with the Research Laboratories of the General Electric Co., Ltd. Four scales give readings from 0 – 5 lm/ft^2; the instrument is portable and made to stand up to rough handling.

THE NORTH MIDLANDS ENGINEERING CO., LTD., took part in the outdoor display showing a selection of their tubular steel street lighting columns for Group B lighting. The firm also manufactures control boxes, brackets, etc., and acts as suppliers of columns, lanterns and equipment of various makes. They also undertake the erection of street lighting equipment.

PHILIPS ELECTRICAL, LTD., showed lamps for street lighting which incorporate developments of considerable interest to public lighting engineers. Since pioneering the sodium lamp in 1932, Philips have carried out continuous research into the improvement of its quality and efficiency. The most recent developments will shortly be incorporated in production runs and the lamps produced will have not only the highest average efficiency yet achieved by any standard commercial lamp, but the light output at the end of life will be almost identical with the initial output. A completely new and revolutionary development is the "bamboo" type discharge tube, designed to maintain the high efficiency by stabilising the distribution of metallic sodium along the length of the tube. This means that the light output will not be affected by lamp position or by vibration so long as the lamp is operated within the limits laid down.

The range of new colour corrected mercury fluorescent lamps is now completed by the addition of a 250-watt version —80-, 125- and 400-watt ratings already being available. The new 250-watt lamp is physically interchangeable with standard MA/V lamps without the necessity for alteration to the lampholder and control gear. Further, it adds excellent colour rendering properties, combined with increased efficiency, to the many other advantages of existing mercury lamp installations.

PHOSCO, LTD., exhibited a series of street lighting lanterns under the name of "Phosware" which besides giving illumination results in accordance with the B.S. Code of Practice, are designed to harmonise with the best of the most modern types of columns, concrete or steel. The designs exhibited included totally enclosed lanterns for 45/60-watt (SO.60) and 85/150-watt (SO.140) sodium lamps; an enclosed lantern for two 2-ft. fluorescent lamps (F.2-40); a vertical type post top lantern for two 2-ft. 20- or 40-watt fluorescent lamps and a general utility lantern of simple design for Group B lighting for use with 100/200-watt tungsten or 80-watt mercury lamps.

POLES, LTD., exhibited in the outside display two of the columns specially produced for lighting of Kuwait. These were (a) a column for 25-ft. mounting height fitted with a fluorescent lantern by Siemens Electric Lamps and Supplies, Limited. The smoothly tapering shape of this column with its flush-fitting door blends in to the lantern, the complete unit being very attractive; (b) 15-ft. mounting height columns for side street lighting incorporating an aluminium bracket of outstanding character and unobtrusive flush-fitting door.

The floodlight structure from the standard range in present production and designed to carry floodlights in heights up to 60 ft. was shown.

Other columns from the "Adastra" range were shown some being painted in different colours.

REVO ELECTRIC CO., LTD., showed a number of recently introduced fittings and columns, including the Revo "Kuwait" lantern. Over 150 of these fittings were recently supplied together with other designs for the lighting of the Civic Centre of Kuwait. The unit comprises a tapered opalescent "Perspex" cylinder 36 in. long x 18 in. diameter at the top and carrying eight 30-watt fluorescent lamps, the cylinder being surmounted by a 4-ft. 3-in. diameter dome accommodating eight 150-watt tungsten lamps and control gear. Another new addition was a tapered version of the Revo "Festival" lantern, a vertical fluorescent unit carrying four 80-watt fluorescent lamps with an enclosing member of opal "Perspex."

New to the range of Group A sodium lanterns was an open type unit with inverted "Perspex" bowl for 85/140-watt sodium lamp. A new four-lamp version of the Revo "Sol-Etern" lantern was also on view and also a special electro-gas lantern designed for conversion schemes.

Other lanterns from the Revo range were also shown, some being shown on Revo columns in the outdoor display.

SANGAMO WESTON, LIMITED, displayed the full range of Sangamo Type SS synchronous time switches, special emphasis being given to the models available for street lighting control, namely, the Types SSC, SSCR, SSFB and SSFC. In addition, examples of Sangamo A.C. Watthour Meters, single phase and polyphase, were exhibited as well as a representative range of Weston electrical instruments; the latter covering all requirements from laboratory standards to miniature panel instruments.

THE SIEMENS BROTHERS GROUP OF COMPANIES exhibited a selection of their lighting products and associated equipment. Street lighting equipment displayed consisted of entirely new lanterns such as the "Kuwait," "Carpenter," "Crawley," "Orbicular" and "Citizen," supported by the widely adopted "City" and "Orton" lanterns. The "Kuwait" lantern constitutes a new departure in street lighting design inasmuch as the lantern has a swan-neck which blends with the pole top and ensures a sweeping unbroken line. Two or three 5-ft. 80-watt fluorescent tubular lamps with anti-corrosion reflectors are used; the "Perspex" bowl is designed to assist the optical characteristics, and a combined sorbo rubber and asbestos gasket completes the sealing. The bowl is secured by one heavy-duty bolt. Mounting height is 25 ft.

The "Coventry" lantern is a double version of the "Kuwait" and in construction is virtually two lantern assemblies mounted onto a single head casting. It is designed for centre-island siting between dual carriage ways.

The "Carpenter" and "Crawley" lanterns are 3-ft. and 2-ft. versions of the "Kuwait" respectively. The "Citizen" is a vertical wall-mounting lantern accommodating two 2 ft., 40-watt fluorescent lamps, which is capable of adaption to pole top and spigot mounting. Siemens "Orbicular" is a 85-watt sodium lamp lantern, cylindrical in shape with self-cleaning features.

Also on show was a representative range of Siemens pole mounting fuse boxes and associated equipment, and a range of tungsten, discharge, fluorescent, and projector lamps manufactured by the Group.

THE SIEMENS AND GENERAL ELECTRIC RAILWAY SIGNAL CO., LTD., showed working demonstrations of the company's "Autoflex" vehicle-actuated road signal system, pedestrian-actuated road signals, and the Sykes vehicle computer for counting vehicles passing a given point in a selected period of time. A new item on the stand was the Duncan-Miller "60" parking meter, now being marketed by S.G.E.

SHAFTESBURY LADDERS LTD., in addition to showing two of their tower ladder units, demonstrated for the first time their new Model B trailer unit designed to ease maintenance of Group B lighting installations.

SPUN CONCRETE LTD. showed two new columns which, like others made by this company, are made by the centrifugal spinning process. The new columns are slender in shape, and particular care has been taken with the placing of the control gear compartment.

THE STANTON IRONWORKS COMPANY'S outdoor display included 12 spun concrete lighting columns, five for Group A and seven for Group B lighting. On the company's indoor stand were shown photographs of the manufacturing process and coloured transparencies, giving views of Stanton lighting column installations.

STEWARTS AND LLOYDS LTD. exhibited a selection of their standard tubular street lighting columns, including 12 standard designs suitable for use on either Group

A or Group B roads. Two of the columns showed external protection against corrosion, consisting of a sprayed metallic coating of aluminium in place of a priming coat of paint. The indoor display included dioramas and photographs showing lighting column installations and model lighting columns.

THORN ELECTRICAL INDUSTRIES LTD. introduced a completely new range of street lighting fittings. Taking pride of place was the "Alpha One" sodium lantern, designed for main highway and motor-road lighting. The "Opticell" and special light control system employed in this lantern are designed to achieve new standards in efficiency and to reduce maintenance costs. The "Alpha Two" is a fluorescent lantern for Group A lighting in town centres and main highways where the pleasing colour and high efficiency of fluorescent lighting is required. This lantern employs a similar light control system and has a specially designed weatherproofing construction to ensure long maintenance-free periods and first-class performance. For Group B lighting the new "Beta One" lantern is simple, robust and inexpensive. Its two-part clear plastic refractor has been specially designed for both tungsten filament and mercury discharge lamps to give a broad distribution ideally suited for the tree-lined residential road or the urban street. Elegant appearance and slim modern lines are the dominant features of the "Gamma One" fluorescent vertical lantern. Its all-round light distribution makes it suitable for lighting avenues, gardens and those streets which are the object of particular civic pride. Also featured were new models of two new street lighting columns created with an eye to the future. The first was a concrete column for the "Alpha One" lantern, with a special bracket, developed in conjunction with Concrete Utilities Ltd. There was also a model of an interesting new timber column in afrormosia, designed to accommodate the "Beta One" lantern.

TUBEWRIGHTS, LTD. (a subsidiary of Stewarts and Lloyds, Ltd.), introduced a new standard floodlighting tower. The tower has been designed to meet the demand from lighting engineers for an economical structure to carry varying arrangements of floodlamps for the high level illuminations of railway sidings, stock yards, car parks, football fields, sports arenas and the like. The tower is available in a range of heights from 30 ft. to 60 ft. in 5 ft. increments, and can be supplied with a round, rectangular or octagonal platform as required. The access ladder is available with or without safety loops and stringers. The tower is made in units of triangular all-welded tubular steel construction which are bolted together on the site, each unit being of convenient length for handling and transport. Steel tube has many advantages when used for tower construction, the foremost being that the wind loads are reduced to nearly half of those for conventional structures, allowing lighter members to be used for the actual structure with consequent reduction in costs and foundations. Other advantages are cheaper maintenance, clean appearance and no internal corrosion of the sealed tubes.

VAUXHALL MOTORS LTD. included in the outdoor display a Bedford-Eagle four-stage tower wagon.

VENNER LTD. showed time switches designed to cover the many time control requirements of public lighting installations. An attractive feature of the exhibit demonstrated the care that is given to the manufacture of time switch components, which is exemplified by a machine performing precise operations on parts of time switch mechanisms. Venner time switches can be supplied with several alternative types of clock to suit individual requirements—15- or 35-day hand-wound, synchronous motor driven both with and without spring reserve, and electrically wound clocks with spring reserve for use on A.C. or D.C. supplies. The range covers single, double or triple pole patterns for controlling loads from 5 to 50 amps. Also demonstrated was the Venner "Park-O-Meter."

Personal

DR. J. N. ALDINGTON, managing director of Siemens Electric Lamps and Supplies, Ltd., has been appointed managing director of the parent company, Siemens Brothers, Ltd., and is now working in London. On leaving the Preston Works, which he joined as a laboratory assistant 35 years ago, he was presented with an illuminated address by Mr. P. D. Oakley, general works manager, and with a gold watch by the staff Mrs. Aldington was presented with a silver entree dish.

MR. RICHARD MCCULLOGH has been appointed managing director of Luminated Ceilings, Ltd. MR. I. D. CAMERON, who was previously technical manager of this firm, has joined the board as technical director. The London office is now at Alliance House, Caxton Street, London, S.W.1.

MR. TOM MURPHY, representative in north-eastern England for The Stanton Ironworks Co., Ltd., lives at 22, Queensway, Brunton Park, Gosforth, Newcastle-upon-Tyne. (Tel. Wideopen 511.)

MR. A. J. FORD, the general works manager for lamp production, has been appointed to the boards of Lamp Presscaps, Ltd., and Manifold Machinery, Ltd.

The Leon Gaster Memorial Premium of the I.E.S. has been awarded to DR. W. E. HARPER and MR. A. G. PALMER for their paper entitled "Lighting of Hazardous and Corrosive Locations in Industrial Plants." DR. HARPER is with the Plastics Division, Imperial Chemical Industries, Ltd., and MR. PALMER is with the North Thames Gas Board.

The I.E.S. Silver Jubilee Commemoration Award has been presented to MR. K. R. ACKERMAN for his contributions to lighting design and brightness patterns. MR. ACKERMAN was formerly with The British Thomson-Houston Co., Ltd., and is now with the British Broadcasting Corporation.

C.I.E. Meeting, Zurich

The name of the Yugoslav delegate in the picture of heads of delegations which appeared on p. 298 of the September issue should have read V. Jovanovic and not as given under the picture.

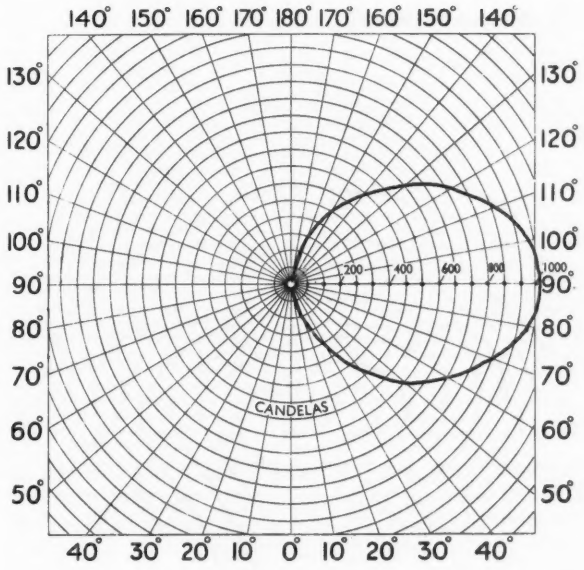
Street Lighting Lanterns

The following review includes street lighting lanterns introduced during the last year. The information given includes some details not previously published in any form and the review will therefore be a ready source of reference for street lighting engineers and public lighting authorities. It should be noted that though lanterns are classified under those intended for Group A or Group B lighting and are further sub-divided under types of light source used, some lanterns may be used with various types of lamp or for main road or secondary road lighting.

Fluorescent Lamp Lanterns for Group A Lighting

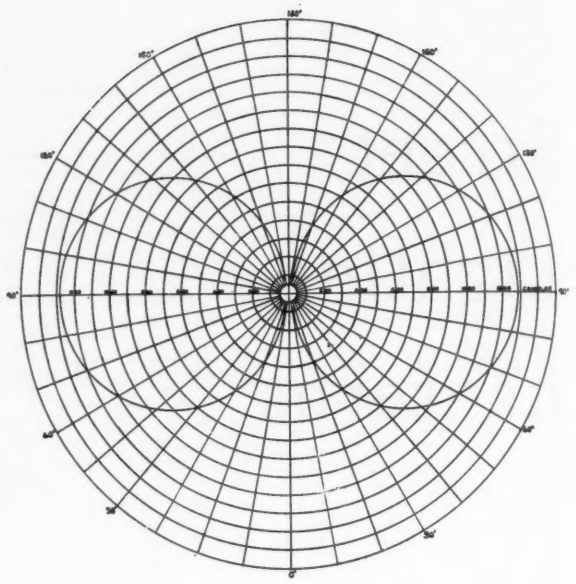
(1) G.E.C. Z8480

This post-top lantern in addition to normal street lighting is suitable for civic centres, main shopping areas and seaside promenade lighting. Suitable for four 5-ft. 80-watt fluorescent lamps. The lantern is an opal "Perspex" cylinder through which runs a central metal barrel carrying two end plates upon which are mounted the lampholders and starter sockets. The bottom copper spinning, which houses the lamp operating gear, and the cast spigot cap are screwed on the centre tube. Over this assembly fits the "Perspex" cylinder. The top copper spinning is secured by a spun finial which when screwed down makes the lantern totally enclosed and weatherproof.

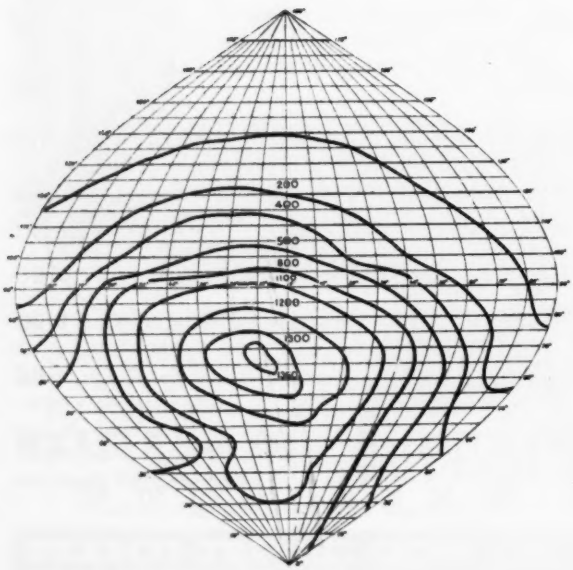


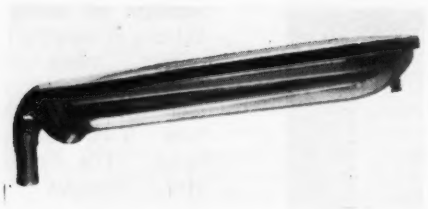
(2) Revo C.14676

This vertical fluorescent lantern, of modern design, consists of a truncated cone of opal "Perspex" surmounted by a spun aluminium canopy with a cast aluminium finial and base. Starter switches are housed in the top of the lantern and the four 5-ft. 80-watt tubular fluorescent lamps are arranged for individual switching if required. The lantern has the advantage of presenting a decorative appearance whilst giving effective illumination to both the roadway and adjacent buildings.



(3) Siemens "Kuwait"

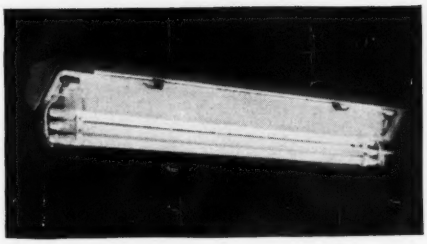


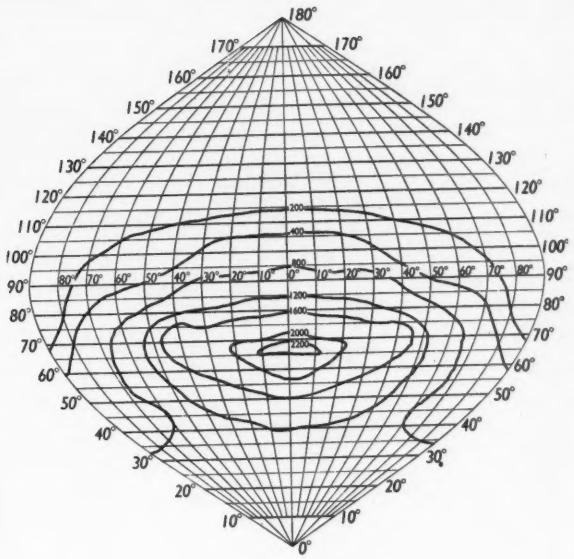


This lantern has a swan neck which blends with the pole top giving a sweeping unbroken line. Because the neck and lantern head are of one complete high-grade aluminium alloy casting, sufficient strength to take the weight of the lantern is assured. Two or three 5-ft. 80-watt fluorescent tubular lamps with anti-corrosion reflectors are used; the bowl is of "Perspex" designed to assist the optical characteristics, and a combined sorbo-rubber and asbestos gasket completes the sealing. The bowl is secured by one heavy-duty bolt. Can be finished in a range of colours.

The double version of this lamp is known as the "Coventry"; also available in 3-ft. and 2-ft. versions, known as the "Carpenter" and "Crawley" respectively.

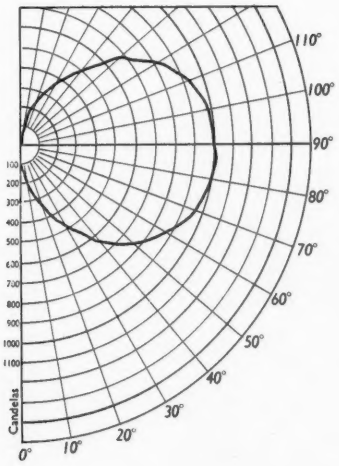
(4) **Thorn " Alpha Two "**





For two or three 5-ft. fluorescent lamps. The canopy and most of the metal work is of aluminium. All external ferrous parts are of stainless steel. The bowl is made from clear acrylic plastic sheet and the refractor plates are injection moulded in a special grade of acrylic plastic. The bowl is supported by two longitudinal rods and is clamped tightly to the body by means of four quick-release fasteners; by releasing the fasteners the bowl hinges sideways on two folding arms which swing it well clear of the lamps. The control gear is contained on a gear tray. To achieve maximum efficiency, light from the source is redirected as little as possible; control of the light is achieved by inclining the planes of the refractor panels inwards towards the lamps and by relying mainly on reflecting prisms.

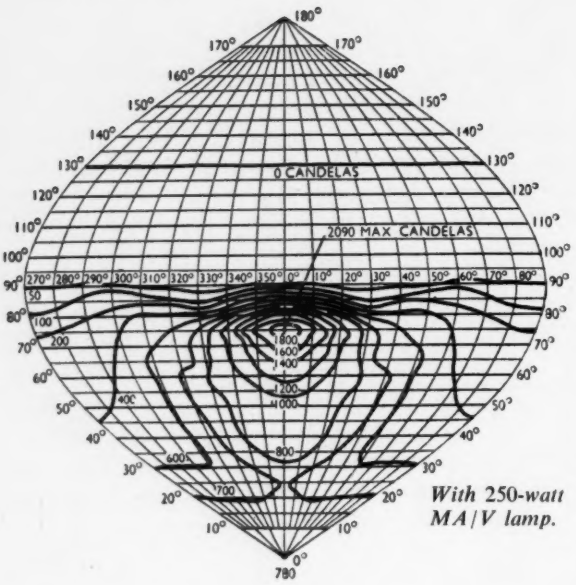
(5) **Thorn " Gamma One "**



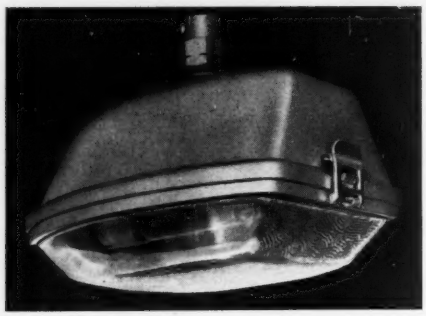
A vertical lantern housing four 5-ft. fluorescent lamps. The plastic diffuser and cap are manufactured as one piece which stands on a small ring gasket at its lower end. By means of a large clamping screw which passes through a gland attached to the cap, the diffuser is tightened down on to the gasket thus virtually achieving an hermetic seal. The diffuser is manufactured from opal acrylic plastic sheet, the cap being of the same material but coloured and cemented to it. The base is a substantial casting of corrosion-resisting aluminium silicon alloy. The lantern requires a spigot 3 in. in diameter by 5 in. long which is gripped by three $\frac{3}{8}$ in. B.S.W. set screws in the base.

Mercury Lamp Lanterns for Group A Lighting

(6) G.E.C. Z8401/2

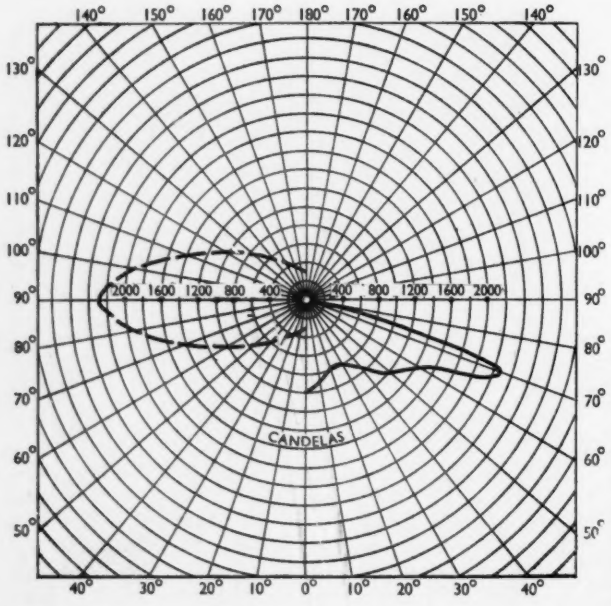


With 250-watt MA/V lamp.

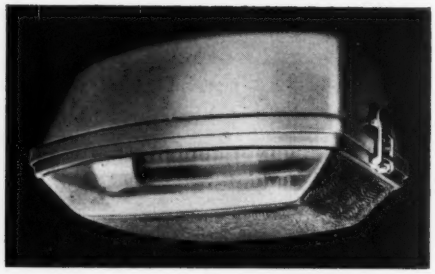


Designed for use with a 250- or 400-watt MA/V or 400-watt MAF/U mercury lamp, the lantern is intended for main road lighting, especially in the vicinity of airfields. Medium angle beam distribution, peak intensity occurs at 75 deg.; at 80 deg. it is two-thirds of the maximum value. The cut-off type of construction produces a rapid run-back above 80 deg. falling to a negligible figure at the horizontal. Top entry mounting can be supplied in open or enclosed versions. Body is of die-cast aluminium-silicon alloy and the light distribution is provided by two curved glass coppered and lead-backed mirror reflectors.

(7) G.E.C. Z8403/4

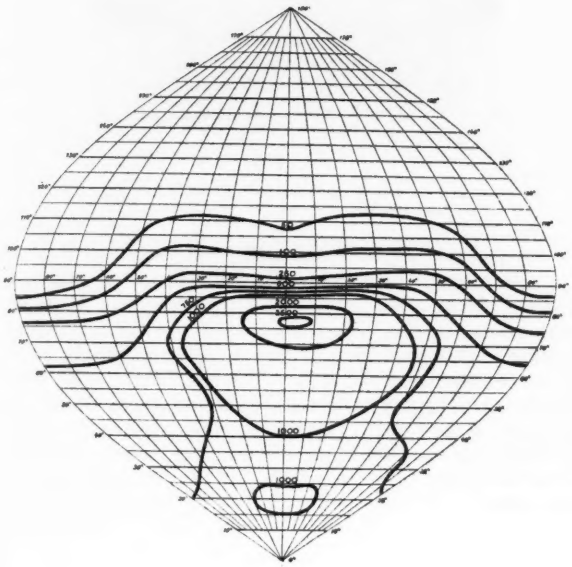


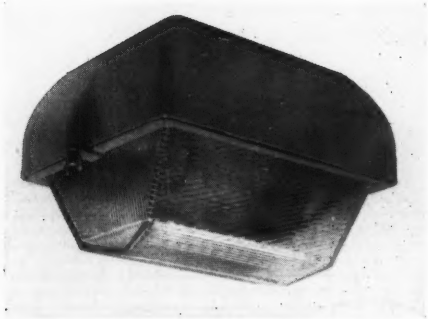
With 250-watt MA/V lamp.



Designed for use with a 250- or 400-watt MA/V or 400-watt MAF/U mercury lamp the lantern is intended for main road lighting, roundabouts, dock and waterside lighting. Cut-off distribution; peak candle power at 70 deg. to the vertical. The lantern is suitable for water side lighting where for navigational purposes it is generally necessary for light to be shielded, and for roundabouts where a cut-off distribution assists visibility. The lantern, which is top entry mounting, can be supplied in open or enclosed versions. The body is of die-cast aluminium-silicon alloy and the light distribution is provided by two curved glass coppered and lead-backed mirror reflectors.

(8) **Siemens " Aldridge "**

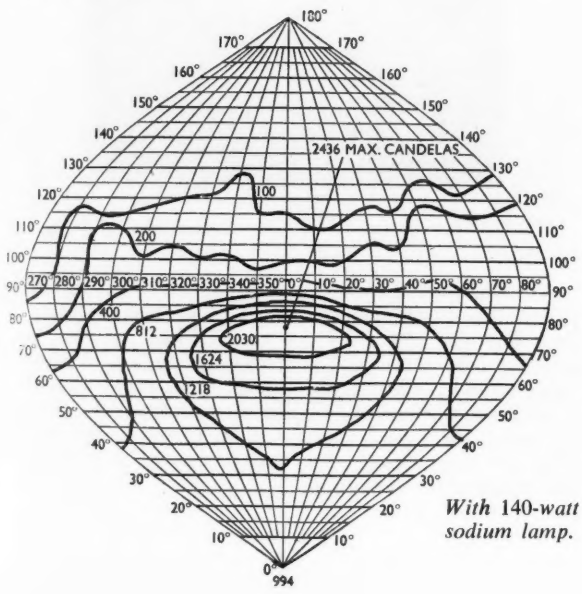




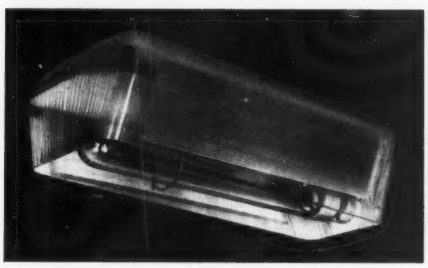
Designed to give minimum angle distribution by means of a reflector and refractor system with 250- or 400-watt mercury lamp. Highly polished reflectors are incorporated with prismatic glass-ware. The main body is of cast aluminium alloy and provision is made for the fitting of a magnetic arc deflector. Directional intensity ratio is 2.6; light output in the lower hemisphere 5,350 lumens; light above the horizontal is 4 per cent.

Sodium Lamp Lanterns for Group A Lighting

(9) **G.E.C. Z9725**

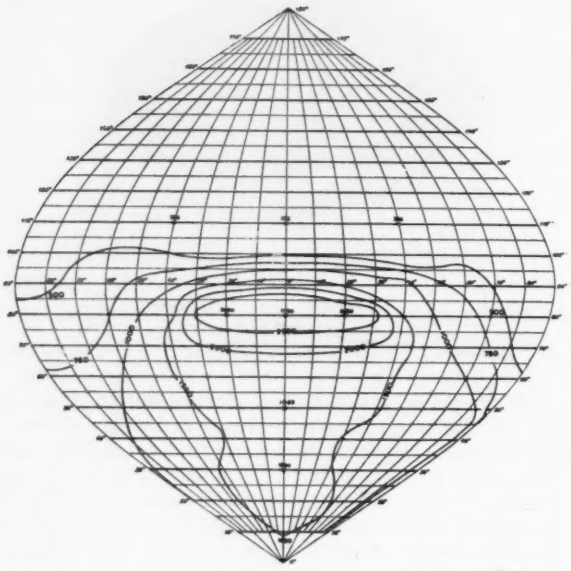


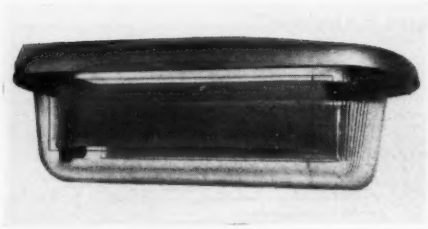
With 140-*watt sodium lamp.*



An open-type lantern for use with an 85-or 140-watt sodium lamp for main road lighting. With top entry mounting, the lantern is essentially a one-piece open inverted " Perspex " bowl to the insides of which are bonded the prismatic sides of the " Perspex " refractor plates. The ends of the bowl have a rimpled finish. A cast aluminium spider on the inside of the lantern carries the mounting boss, lamp steady and terminal block. A smaller version is available for side road lighting, using a 45- or 60-watt sodium lamp.

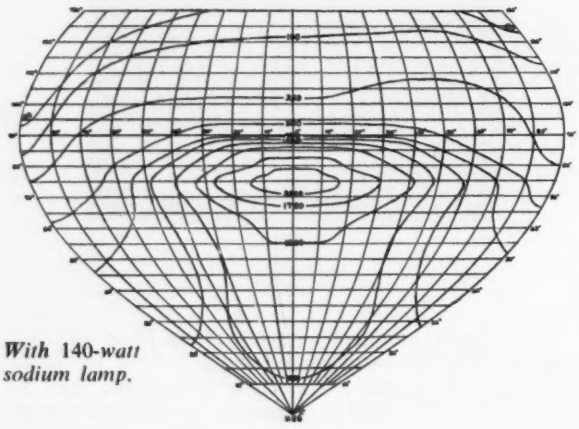
(10) **Phosco " SO.140 "**



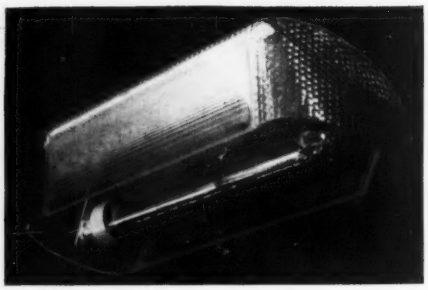


An enclosed type lantern for use with 85- or 140-watt sodium lamps. The hood and hinged ring are made of high-grade non-corrosive aluminium alloy which is further treated with a protective undercoat. The enclosing bowl is to a special design in " Perspex " arranged with machined " Perspex " prismatic panels sealed to the inside surfaces of the bowl. The hinged ring carrying the bowl is fitted with a robust quick release catch, which seals the bowl by means of a felt gasket. Made for either top or side entry.

(11) **Revo C.14674**

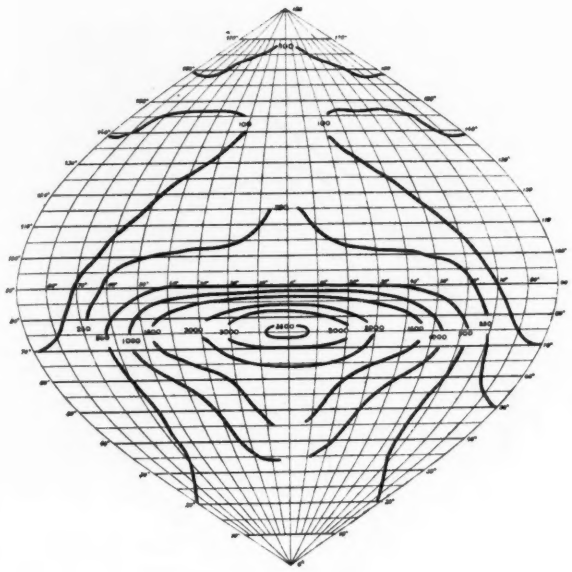


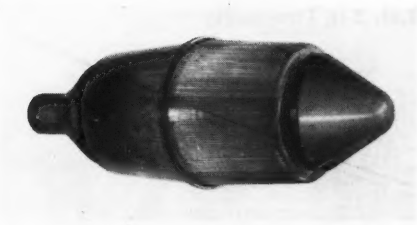
With 140-*watt sodium lamp.*



A one-piece " Perspex " canopy forms the main body of this " open-type " lantern for 85/140-watt sodium lamp. Two internal " Perspex " refractor panels are securely sealed to the sides providing smooth surfaces for easy cleaning and preventing the ingress of dust and moisture to the prismatic faces. The internal reflector is of vitreous enamelled sheet steel and has in its centre a removable block for easy wiring. The lantern can be supplied for top or side entry mounting.

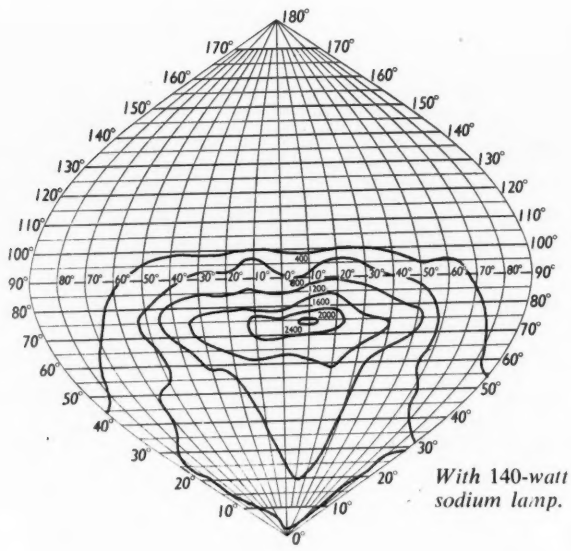
(12) **Siemens " Orbicular "**



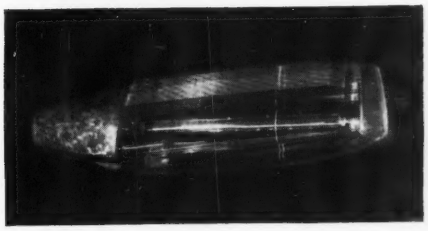


The " Orbicular " is a hermetically sealed side-entry lantern designed for 85-watt sodium lamps. Features include simple maintenance and installation, provision for adjustment to cater for road gradients, and self-cleaning characteristics provided by the cylindrical glass-ware.

(13) **Thorn " Alpha One "**



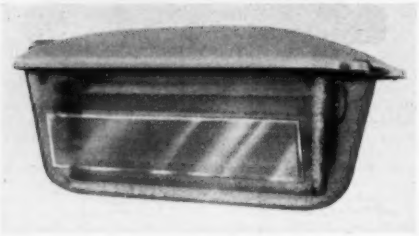
With 140-*watt sodium lamp.*

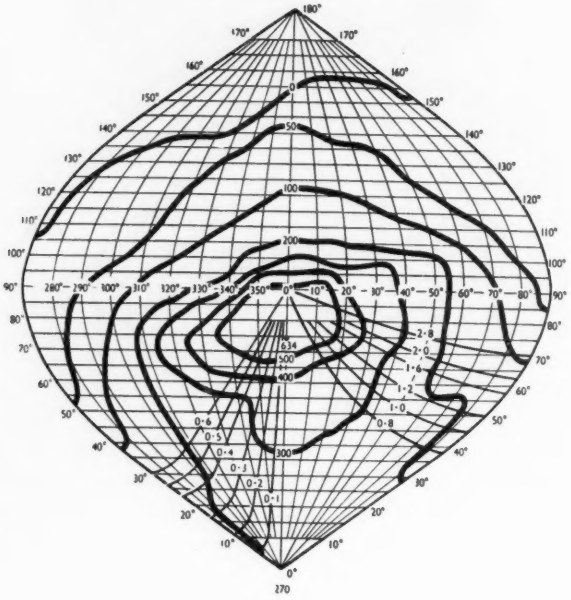


The hermetically sealed lamp enclosure and light control system, the " Opticell," is a unified assembly of two plastic mouldings, an auxiliary reflector with the lamp support and two stainless steel support pins. The 85- or 140-watt sodium lamp is inserted through an aperture at one end, which is then tightly closed by a combined lampholder and sealing cap held in place by two quick-release clips. The " Opticell " is made from a special heat- and weather-resisting grade of clear acrylic plastic. The end support and sealing cap are of corrosion-resisting aluminium-silicon alloy and other metal components are of stainless steel or aluminium.

Fluorescent Lamp Lanterns for Group B Lighting

(14) B.T.H. 2-ft. Fluorescent

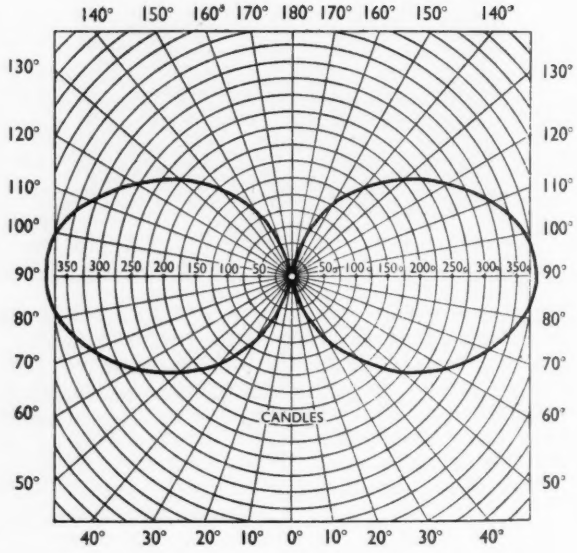




This is a 2-ft. lantern mounting two 40-watt fluorescent lamps. Similar in construction to the "Amber" this lantern comprises a corrosion-resistant cast silicon aluminium alloy canopy with a hinged single-piece "Perspex" bowl. The two lamps are mounted one above the other and their output is controlled by an aluminium reflector and by "Perspex" refractor plates sealed to the bowl, the remainder of which has a slightly diffusing finish.

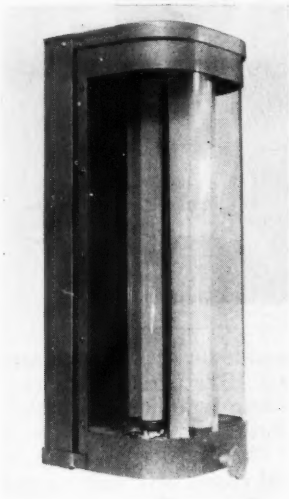
(15) G.E.C. ZD10173

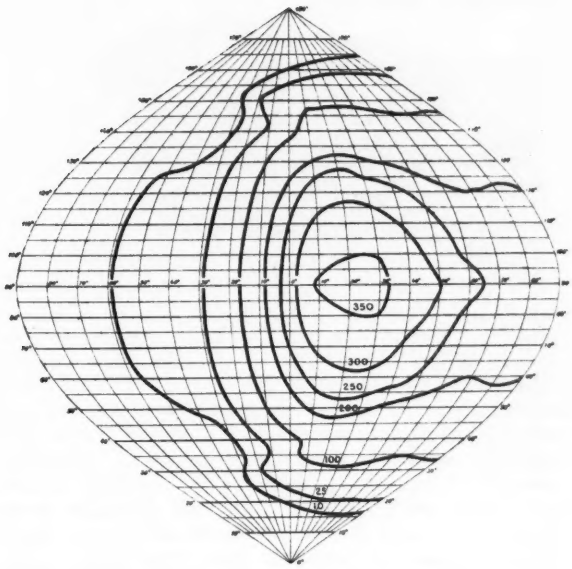
Suitable for four 2-ft. 20-watt or 40-watt fluorescent lamps. The lantern is a tapered "Perspex" cylinder, through which runs a central metal tube carrying two end plates; the lower plate carries four bi-pin lampholders — the upper plate is fitted with lampholders and starter sockets. The bottom copper spinning and cast iron spigot cap are screwed on to the centre tube. Over this assembly the "Perspex" cylinder fits, resting on the spinning. The top spinning, which is also of copper, is secured by a spun finial which, when screwed down, makes the lantern totally enclosed and weatherproof. The gear must be housed outside the lantern.



With four 40-watt lamps.

(16) **Siemens " Citizen "**

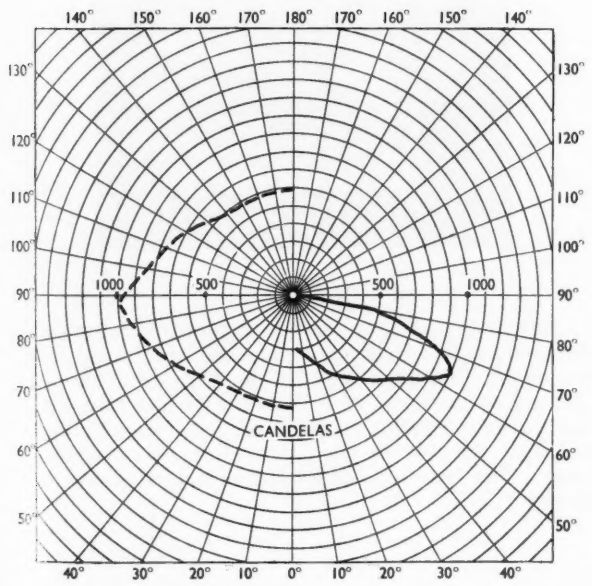




Vertical wall-mounting lantern accommodating two 2-ft. 40-watt fluorescent lamps. Control-gear is built into the lantern and light control is by means of polished aluminium reflectors. Lantern is of cast alloy and steel with a " Perspex " cover. Can be adapted for pole-top and spigot mounting.

Mercury Lamp Lanterns for Group B Lighting

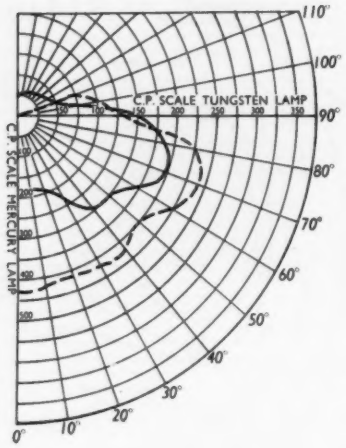
(17) **G.E.C. Z.5407**

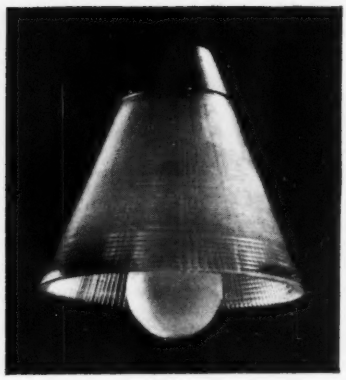


With 125-watt MB/U lamp.

For use in side roads, particularly in the vicinity of airfields, and for dock and waterside lighting. Uses a 60/200-watt tungsten or an 80- or 125-watt MB/U or MBF/U mercury lamp. Top entry mounting, the lantern has a cast-iron top and a heavy gauge spun copper main body carrying the one-piece silvered, coppered and lead-backed glass reflector which provides the optical distribution. The lantern can be supplied in open or enclosed versions and with a symmetric, axial or non-axial asymmetric light distribution.

(18) Thorn "Beta One"

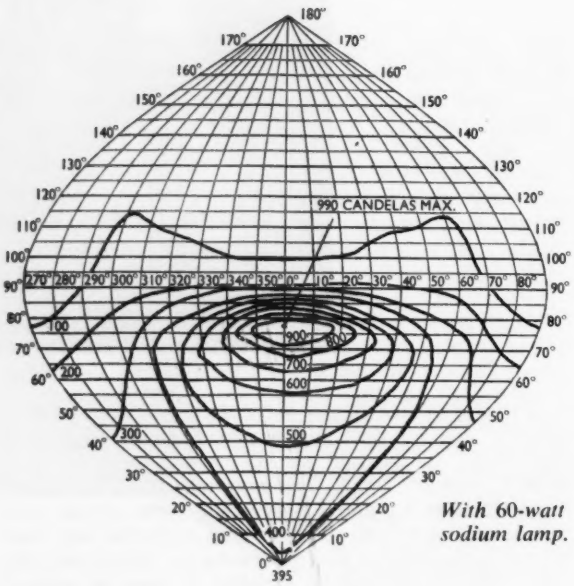




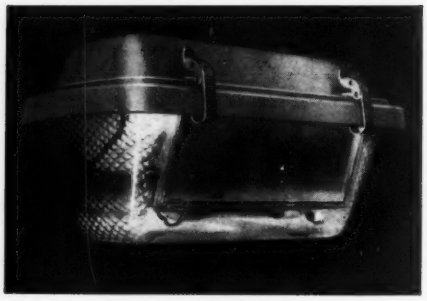
Open refractor lantern suitable for 150-watt tungsten lamp or 80-watt mercury lamp. The refractor is a two-part assembly of clear plastic injection mouldings, attached by a single-turn thread to a robust diecast aluminium-silicon gallery. The exterior is perfectly smooth and the interior vertical prisms have well-rounded tips to minimise dirt accumulation. The refractor is located correctly by a single "click" spring. Top entry tapped $\frac{3}{4}$-in. gas thread. Two types of distribution are available, a two-way non-axial type particularly suitable for Group "B.1" roads and a symmetrical type which meets the requirement for Group "B.2" roads.

Sodium Lamp Lanterns for Group B Lighting

(19) G.E.C. Z9456

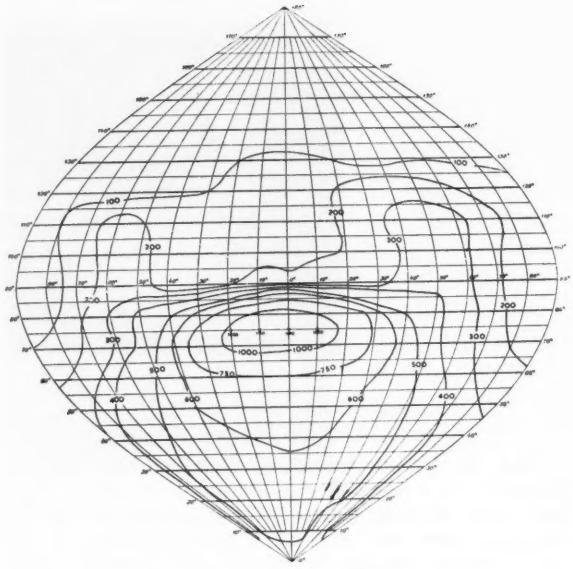


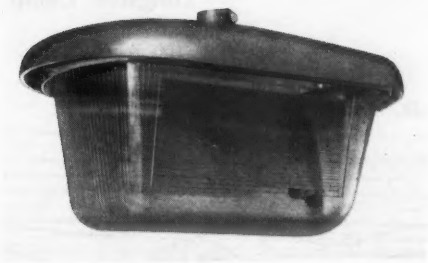
With 60-watt sodium lamp.



This lantern uses an injection moulded refractor bowl designed for side road sodium lanterns which supersedes the blown "Perspex" bowl. The refractor plates are recessed on the inside of the bowl to facilitate cleaning, and the bowl presents an attractive appearance by night and day. Suitable for use with a 45- or 60-watt sodium lamp. The lamp operating gear is housed within the lantern body.

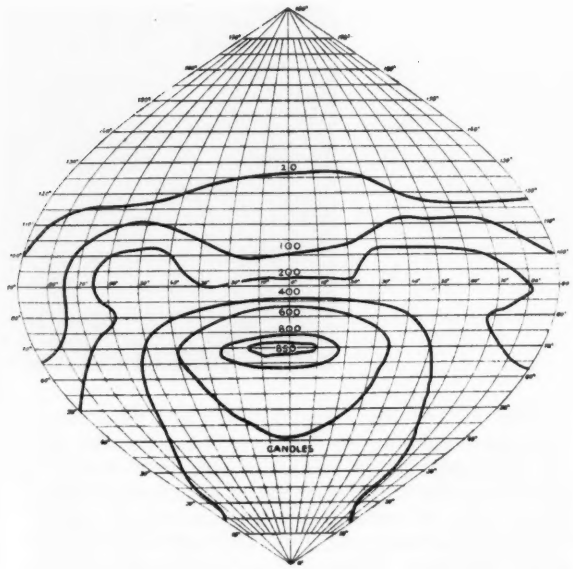
(20) **Phosco " SO.60 "**

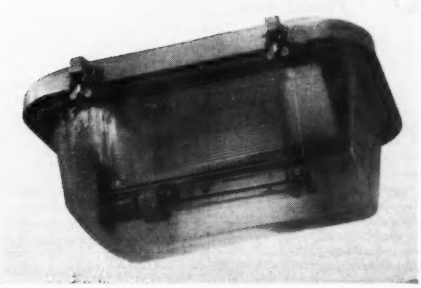




This lantern, designed to harmonise with most brackets and columns, is for 60-watt sodium lamps. Made for either top or side entry, the hood and hinged ring are made of high-grade non-corrosive aluminium alloy which has been further treated with a protective undercoat. The specially designed " Perspex " enclosing bowl is arranged with machined " Perspex " prismatic panels sealed to the inside surfaces of the bowl. The hinged ring which carries the bowl is fitted with a quick release catch which seals the bowl by means of a felt gasket. Also included in this series is the Phosco " SO.45 " lantern for use with 45-watt sodium lamps.

(21) **Siemens " Orion "**

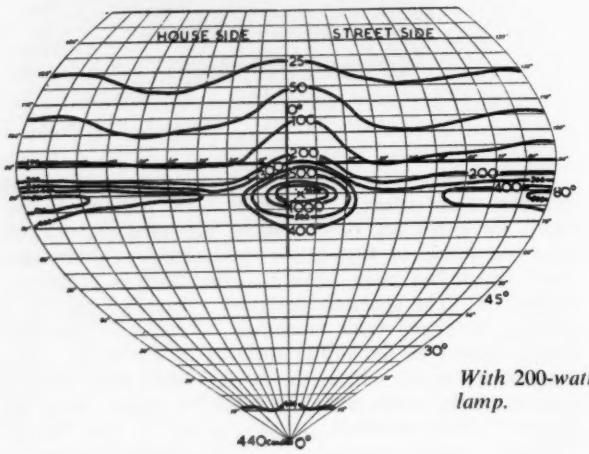




Designed for use with 85-watt sodium lamps; cast aluminium alloy lantern with totally enclosed refractor system. The control-gear is housed within the lantern body beneath the " Birmabright " reflector assembly.

Tungsten Lamp Lanterns for Group B Lighting

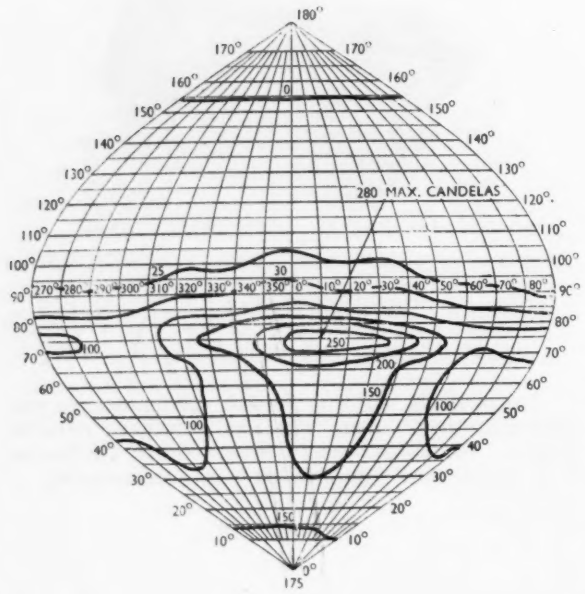
(22) Falk, Stadelmann "Firefly"



With 200-watt lamp.

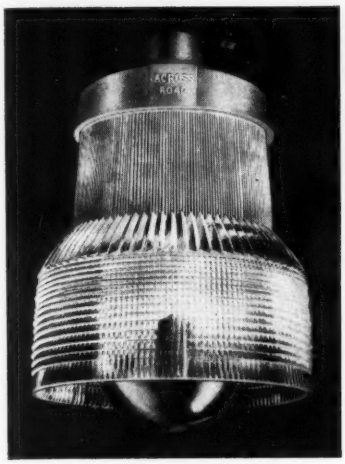
This lantern for Group "B" roads has been redesigned with a new type die-cast aluminium alloy single-piece hood and outer reflector. The springs for the reflector retaining hooks are recessed in pockets formed in the casting giving complete protection and improved operation. All metal parts, including screws, are non-ferrous. A Holophane single piece dome type refractor is used, available for non-axial, symmetrical or axial light distribution. For use with 100-, 150- or 200-watt tungsten lamps or 80- or 125-watt mercury lamps. The hood is anti-corrosion treated.

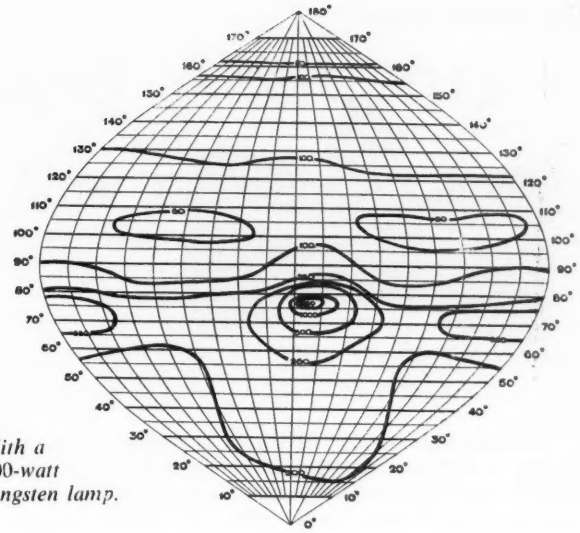
(23) G.E.C. "Plastifractor"



This lantern has a plastic, one-piece refractor bowl controlling light in the horizontal and vertical planes. Injection moulded in "Diakon" the bowl has a non-axial symmetric distribution suited to side street lighting. The method of manufacture ensures a high degree of repetitional accuracy, more efficient light control because of the high finish obtainable on the prisms, great impact resistance and light weight. The non-axial distribution is obtained by vertical prisms on the outside of the bowl and horizontal prisms on the inside. The lantern is intended for low wattage tungsten or mercury lamps.

(24) **Holophane " Lumifractor "**

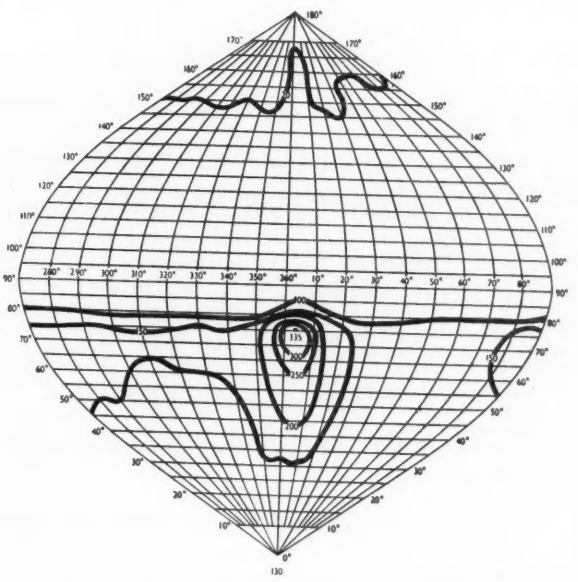




With a 200-watt tungsten lamp.

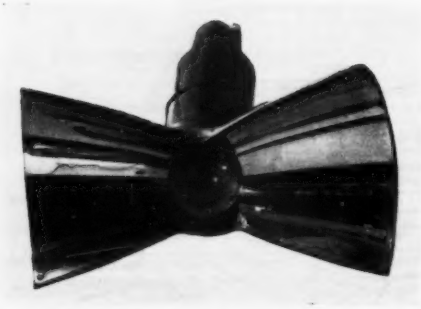
This refractor type lantern presents a simplified and inexpensive application of the popular single piece dome refractor for narrow Group " B " roads. Suitable for use with lamps up to 200 watts (filament or blended) or up to 125 watts (mercury or fluorescent). Also suitable for 80-watt MB/U lamps, 80-watt MBF/U, 160-watt MBT/U and 200-watt MBT/V lamps. The design embodies a glass canopy integral with the refractor, with quick action attachment to a weathershed cast aluminium boss which carries the lamp-holder mounting and provides $\frac{3}{4}$-in. BSP top entry. The refractor consists of single piece glass with prisms for light control moulded on inner and outer surfaces and is designed to facilitate cleaning.

(25) **Metropolitan-Vickers " Star-cone "**

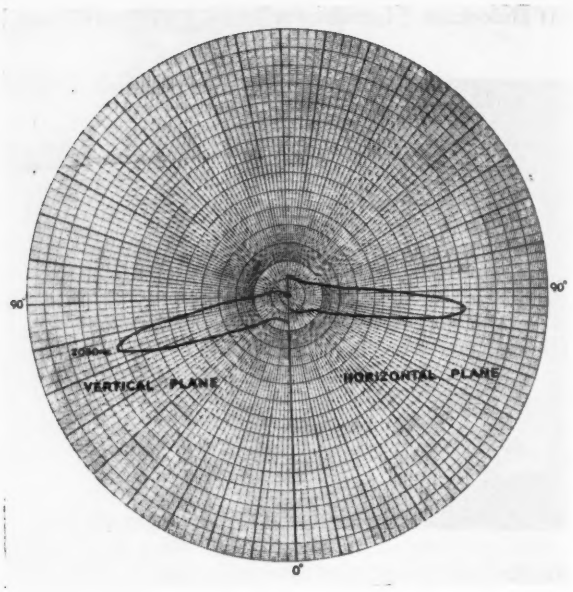


An open refractor lantern. It incorporates the material " Diakon " which is a clear thermo-plastic of the " Perspex " family, suitable for injection moulding, resistant to corrosion and virtually unbreakable. It is suitable for use with a 75- or 150-watt tungsten lamp or an 80-watt mercury lamp (type MB/U or MBF/U). It consists basically of a cast silicon aluminium canopy, with provision for $\frac{3}{4}$-in. BSP top entry mounting and a one-piece " Diakon " refractor, which lock together to form a smooth cone shape. Three sprung captive screws located inside the lip of the canopy engage with three keyhole slots in the refractor, placed asymmetrically to ensure correct positioning of the refractor in relation to the road. The refractor is available for symmetrical or asymmetrical light distribution.

(26) **Siemens "Florida"**



Designed for use with 100-, 150- or 200-watt tungsten lamps, or alternatively 80-watt or 125-watt MB/U and MBF/U discharge and fluorescent lamps; intended as a versatile Class B road lighting unit.



Names and addresses of firms whose lanterns are described on pp. 381—394.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.

Falk, Stadelmann and Co., Ltd., 91, Farringdon Road, London, E.C.1.

The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Holophane Ltd., Elverton Street, Vincent Square, London, S.W.1.

Metropolitan-Vickers Electrical Co., Ltd., St. Paul's Corner, 1-3, St. Paul's Churchyard, London, E.C.4.

Phosco Ltd., Hoe Lane, Ware, Herts.

Revo Electric Co., Ltd., Tipton, Staffs.

Siemens Electric Lamps and Supplies Ltd., 38-39, Upper Thames Street, London, E.C.4.

Thorn Electrical Industries Ltd., 233, Shaftesbury Avenue, London, W.C.2.

Street Lighting and Accidents

A Study of some New Installations in the London Area

By J. C. TANNER, M.A., F.S.S.,
and A. W. CHRISTIE, M.A., B.Sc.*

This article gives the results of a study of accident frequencies before and after the introduction or improvement of street lighting on some main roads in the London area. Some earlier accident figures for these roads have been given previously in papers [1, 2] to the Association of Public Lighting Engineers at Eastbourne and to the International Commission on Illumination at Zurich. These two papers also referred to other investigations into the relation between light and accidents, but the results given in the present article provide the most clear-cut evidence of the value of improved lighting from the safety point of view.

Details of Sites

The locations of the sites are shown in Table I. They are all on Class I roads, mostly of a fairly high general standard. They were selected for study without reference to the accident data and so the results should be applicable to other similar sites.

Old Lighting

In most cases the roads were lighted previously by low-powered lamps on short columns which were spaced too widely and sited badly. In some cases there was no lighting at all.

TABLE I.

Location of Installations

A.10 (formerly A.108), Great Cambridge Road (Enfield, Middlesex), between U.D.C. boundaries at Progress Way and north of junction with A.105.

A.12 Eastern Avenue (Wanstead and Woodford, Essex) between High Street, Wanstead, and Redbridge Lane.

A.113 (Wanstead and Woodford, Essex), between borough boundaries near Cambridge Road and Woodford Bridge.

A.24 (Sutton and Cheam, Surrey), between borough boundaries near Tudor Avenue and Elm Road West.

A.217 Sutton By-pass (Sutton and Cheam, Surrey), between junctions with Brighton Road, A.297.

A.232 (Sutton and Cheam, Surrey), between borough boundaries at Anne Boleyn's Walk and Albert Road.

A.406 Woodford Avenue (Ilford, Essex), from Gants Hill Station to borough boundary near Clayhall Avenue.

A.550 (Friern Barnet, Middlesex), from junction with North Circular Road A.406 to junction with A.1000 (formerly A.1).

* The authors are with the Road Research Laboratory, Department of Scientific and Industrial Research.

TABLE II.

Details of New Installations

Road number	Dual or single carriageway	Width of carriage-way (ft.)	Type of lamp	Lamp wattage	Lantern light distribution	Normal spacing (ft.)	Length of installa-tion (miles)	Date of coming into operation
A.10	Single	24	Horizontal mercury	400	Medium angle	120	3.0	Oct., 1952
A.12	Dual	24	,,	400	,,	120	0.5	April, 1949
A.113	Single	22–30	,,	400	,,	120	2.8	March to June, 1950
A.24	,,	22–48	Horizontal sodium	140	,,	120	1.9	July, 1952
A.217	,,	30–44	,,	140	,,	120	3.4	Aug. to Oct., 1952
A.232	,,	20–30	,,	140	,,	120	2.1	June to July, 1952
A.406	Dual	24	,,	140	High angle	130	1.3	Feb. to April, 1951
A.550	Single	30	,,	140	Medium angle	120	2.3	July, 1949, to March, 1950

TABLE III.
Values of r for each site, all types of accident together

Site	Value of r	Whether significantly different from unity
A.10	0.47	Yes (at 1 per cent. level)
A.12	0.20	No
A.113	0.47	No
A.24	0.86	No
A.217	0.82	No
A.232	0.78	No
A.406	0.96	No
A.550	0.73	No
All	0.65	Yes (at 1 per cent. level)

During the period under consideration there were some slight variations in the ratio of casualties at night to those by day (presumably reflecting changing traffic patterns), but it is reasonable to assume that any large consistent change in this ratio at the sites studied is due mainly to the lighting rather than to this trend. Accordingly, the effect of the lighting has been measured by the change in the night/day ratio between the "before" and "after" periods.

The figures were divided up by severity of accident, and by whether or not a pedestrian was injured, as well as by light and site. Throughout this article the term "daylight" includes dusk.

TABLE IV.
Accidents before and after lighting improvements, all eight sites combined

		Involving a pedestrian				Not involving a pedestrian				Total			
		Fatal	Serious	Slight	Total	Fatal	Serious	Slight	Total	Fatal	Serious	Slight	Total
Daylight	Before	1	26	47	74	8	40	243	291	9	66	290	365
	After	4	23	58	85	3	46	284	333	7	69	342	418
Darkness	Before	6	14	17	37	4	25	95	124	10	39	112	161
	After	1	8	11	20	2	19	79	100	3	27	90	120
After/Before	Daylight	4.00	0.88	1.23	1.15	0.38	1.15	1.17	1.14	0.78	1.05	1.18	1.15
	Darkness	0.17	0.57	0.65	0.54	0.50	0.76	0.83	0.81	0.33	0.69	0.80	0.75
r		0.04	0.65	0.52	0.47	1.33	0.66	0.71	0.70	0.39	0.66	0.68	0.65
Significance level		5 per cent.	—	—	2 per cent.	—	—	—	5 per cent.	—	—	5 per cent.	1 per cent.

New Lighting

All the new installations are to the standard specified in the B.S. Code of Practice ([3]) for Group A lighting, the luminous flux emitted being towards the upper end of the range of values recommended. In all cases a staggered formation with a mounting height of 25 ft. was used with the usual rearrangements on curves and at junctions. Where there is a dual carriageway each half is separately lighted. Details of the new installations are given in Table II. The normal spacing quoted refers to straight sections of the road. Both sodium and mercury lamps are included, but all are horizontal-burning so that none of the lanterns has the very high angle beam distribution usually associated with vertical-burning lamps.

Analysis of Accidents

The accident data have been obtained from the records of the Metropolitan Police and refer to personal-injury accidents only.

For each site, data were obtained for periods of between one and two years before the change and periods of the same length and at the same times of year after the change. Differences between the "before" and "after" periods should therefore be due only to the effect of the improved lighting, to real trends in accident frequencies from one period to another and to chance variations.

We use the quantity—

$$r = \frac{\text{accidents in darkness after relighting}}{\text{accidents in darkness before relighting}} \Big/ \frac{\text{accidents in daylight after relighting}}{\text{accidents in daylight before relighting}}$$

to measure the effect of the change at a particular place. If the change had no effect then the change in dark accidents would be the same as the change in daylight accidents, and so, apart from chance variations, $r = 1$. If the improved lighting completely eliminated night-time accidents, then $r = 0$. Table III gives values of r defined in this way for each site, all types of accident being taken together. In every case accidents at night decreased relatively to those by day (i.e., r is less than unity). In one case, the Great Cambridge Road, Enfield, the reduction at night was "statistically significant" at the 1 per cent. level. This means that there is less than a 1 per cent. chance of such a large apparent reduction occurring by chance. In two further cases, those in Wanstead and Woodford, the decreases were nearly significant, the corresponding probabilities being between 5 and 10 per cent. (A probability of less than 5 per cent. is normally required for a difference to be called significant.)

The variations between the values of r at the eight sites are not large enough to indicate that the real effect of the lighting has differed from one site to another but are of the order of magnitude which might have been expected as a result of purely chance variations. We are therefore justified in combining the data from all the

sites to obtain a combined estimate of the effect of improved lighting of the type being considered. Table IV gives this combined estimate, together with similar estimates for particular types of accident.

It will be seen that the overall reduction in accidents in darkness was 35 per cent. ($r = 0.65$). The reliability of this figure is such that, while we can be confident that there was a real improvement, there is a 1 in 10 chance that the true effect lies outside the range 20 to 50 per cent.

Fatal accidents show a particularly marked decrease, from 10 to 3, though the figures are too small for the effect to be measured with any precision. This decrease is in accordance with the fact that the proportion of fatal accidents over the country as a whole is about twice as great in darkness as in daylight.

Pedestrian accidents show a particularly marked decrease also. Again, this is in accord with other data, mentioned in references (1) and (2).

Because it has not been possible to demonstrate that there are differences between the effects of the lighting at different sites it is unlikely to be profitable to look for special features of the roads or the lighting at the sites which appear to show the greatest reduction in night-time accidents. It will be noted, however, that the three sites which show the greatest apparent reductions (A.10, A.12, A.113) are the three with mercury lighting. The remainder have sodium lamps. However, when these figures are taken in conjunction with other accident data, no difference can be established between the effects of mercury and sodium installations.

Economic Benefits

A very approximate calculation can be made to see whether or not the monetary cost of the accidents prevented by the improved lighting was sufficient to pay for the new installations. From Table IV, there were 120 accidents in darkness in the "after" period, instead of an expectation of $\frac{418 \times 161}{365} = 184$. The saving was therefore 64. This saving was spread over 17.3 miles of road over, on the average, nearly two years, or more precisely, over 30.8 mile-years. Thus the saving can be expressed as $\frac{64}{30.8} = 2.08$ personal-injury accidents per mile per year. Using the conventional figure of £500 for the average cost of a personal-injury accident (the appropriate figure in darkness is probably greater than this average), the saving is £1,040 per mile per year, or £15,600 per mile over 15 years. Now the capital and running costs of a mile of lighting of the sort studied is of the order of £10,000 over 15 years, so the extra cost of the improved lighting will be somewhat less than this, after allowing for the running cost of the old installations. We can therefore say that the saving in accidents almost certainly paid for the new lighting. This calculation is, of course, very approximate; it takes no account, for example, of the benefits of improved lighting other than the monetary cost of the accidents saved. Nor does it take into account the saving due to the discontinuation of the old lighting.

Conclusions

(i) The introduction or improvement of street lighting on the eight roads studied reduced the frequency of accidents in darkness by about 35 per cent.

(ii) The reductions were particularly great for fatal accidents and for those involving pedestrians, but the number of accidents was too small for these effects to be measured with any precision.

(iii) There is little doubt that the monetary cost of the accidents saved was sufficient to pay for the capital and running costs of the new installations.

Acknowledgments

The Laboratory wishes to thank the Metropolitan Police for making their accident records available and the Surveyors of Enfield, Wanstead and Woodford, Sutton and Cheam, Ilford and Friern Barnet for supplying information about their improvements.

The work described here was carried out as part of the programme of the Road Research Board of the Department of Scientific and Industrial Research, and this article is published by permission of the Director of Road Research.

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Recent Street Lighting Installations

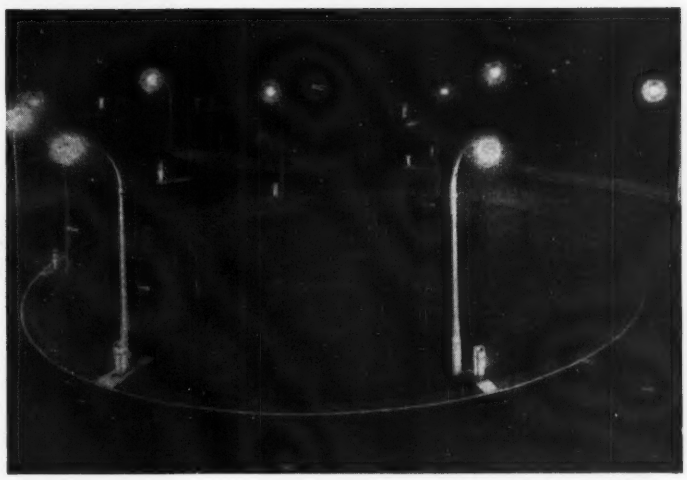
Sodium lighting in Salford

Some 140 sodium street lighting lanterns (140 watt) have been installed on main roads in Salford as the initial stage of a major programme for the relighting of the city. On part of the Bolton Road, which is the main trunk road through Salford to the north-west, the unusually wide carriageway necessitated the opposite mounting of lanterns and alternate centre suspension of lanterns. Existing traction poles were used to support the span wires. The provision of span wire mounting for the lanterns presented the usual difficulties in attaining maximum mounting height. With the conventional top entry lantern a loss in mounting height of at least 12 in. must be accepted. To overcome this difficulty four short angle brackets were fixed to the corners of a side-entry type enclosed lantern, and secured to the span wires by U bolts. Control gear was housed at the top of each traction pole. Should the traction poles be replaced by normal columns in the future, the lanterns can be remounted on side entry brackets.

The Cromwell roundabout, which is situated on the A576 road, at a five-road intersection, is the first roundabout to be constructed in the city, the diameter being 100 ft. and the road width approximately 30 ft. This also is lighted by B.T.H. sodium enclosed lanterns, in this case being mounted on Concrete Utilities Avenue 3D columns at a height of 25 ft. On the main traffic routes the columns are staggered at intervals of approximately 120 ft.

The installation was planned by the City of Salford Street Lighting Superintendent and installed by the street lighting department.

Bolton Road, Salford



Cromwell roundabout, Salford

Two decorative fluorescent installations

(1) Plymouth

Royal Parade, in the new city centre of Plymouth, is a spacious thoroughfare 150 ft. wide between building lines. There is a 22-ft. pavement on the north side, 9-ft. bus bays north and south, two 22-ft. carriageways separated by a 10-ft. central reservation, and on the south side a width of 56 ft. occupied by flower beds and a footpath. The Parade occupies the site of two former parallel streets and various intersections which existed before the destruction of the centre of the city in air raids during the war. It is distinguished by the modern architecture of the new buildings.

In calling for a lighting scheme for Royal Parade, and for Armada Way, which runs into it, the City Architect required lanterns which would be in keeping with their surroundings as well as providing the optical efficiency necessary for illuminating this exceptionally wide thoroughfare. Lanterns were specially designed to meet these requirements by The General Electric Co. Ltd.; those for the main lighting are of two sizes but generally similar design. Those in Royal Parade each accommodate 24 "Natural" 2-ft. 40-watt fluorescent lamps, of which 16 are vertical and eight are horizontal in a radial arrangement at the top of the lantern. The Armada Way lanterns house eight vertical lamps of the same wattage and colour.

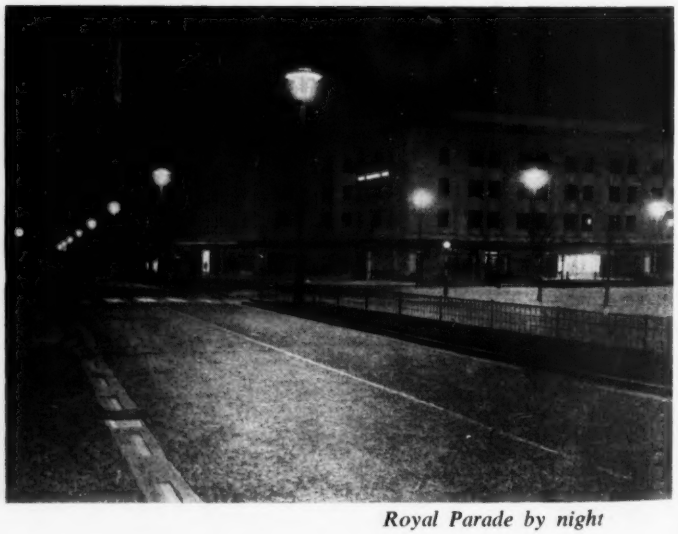
The 14 24-tube lanterns in Royal Parade are in a single line on the central reservation, mounted on 25-ft. concrete columns at 90-ft. spacing. Because of the wide expanse of the footpath and flower beds on the south side of the Parade, there is additional lighting for pedestrians on this side from 13 matching lanterns on 15-ft. concrete columns, in which the light source is a group of eight tungsten lamps burning horizontally.

Both fluorescent lantern designs consist basically of a glazed metal framework built round a central barrel. The metalwork is copper, finished bronze, and the eight vertical side panels are glazed with Morocco glass. An octagonal top portion housing the radial tubes in the Royal Parade lanterns has white flashed opal glass. These lanterns are 4 ft. high and 4 ft. 3 in. in diameter.

The vertical lamps are mounted in pairs on vitreous enamel reflectors, to the back

Royal Parade, Plymouth

Armada Way, Plymouth



Royal Parade by night

of which the gear is attached. One side panel of the lantern can be opened, and, after loosening a thumb screw, the complete assembly of reflectors, gear and lamp can be rotated until the unit requiring attention comes into position for removal through the door. Each unit is connected through a flexible lead, a two-pin plug and socket, and the lantern wiring to a terminal block at the base of the lantern. A complete unit consisting of reflector, pair of lamps and gear can thus be taken out by undoing two knurled nuts and disconnecting its plug.

The radial lamps are arranged similarly in pairs on removable reflectors complete with gear, but are not rotatable, as any one of four horizontal glazed panels can be removed for access to a particular unit.

In Armada Way the lanterns are similar to those in Royal Parade, except that they contain eight vertical lamps only. This installation when completed will consist of 23 lanterns on 25 ft. concrete columns in two rows some 30 ft. apart on the central reservations, and at 90 ft. spacing between columns in the line of the street.

The erection and installation work was carried out by the South Western Electricity Board under the supervision of the Manager in Plymouth, Mr. N. Axford.

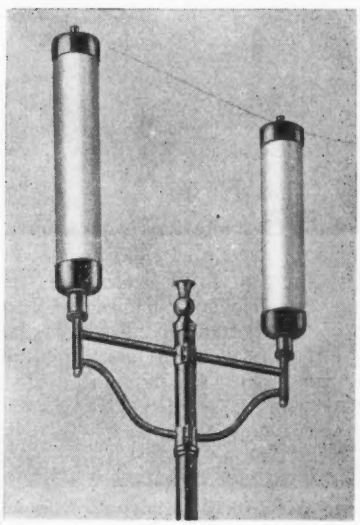
(2) Edinburgh

The tests of various types of street lighting initiated a year ago in George Street, which after Princes Street is the most important street in modern Edinburgh, have now been concluded. Four sections of the street have for some months been simultaneously lit in four different ways.

Since the mounting of lanterns on the buildings would have involved irregular mounting heights and cellarage under the side walks the whole length of the street makes the erection of side lighting columns impossible, central lighting must be maintained. All the trial lanterns were therefore mounted in pairs on the poles in the middle of the street previously employed for overhead tram trolley wires.

The decision has been taken to relight the whole street with G.E.C. vertical lanterns each housing four 5-ft. 80-watt hot cathode fluorescent lamps which were judged to be the most successful from the lighting, economic and aesthetic aspects. Vertical tubular lanterns give motorists in this street the most comfortable seeing conditions, while the light they emit above the horizontal gives a pleasant overall illumination of the façades of buildings. Hot cathode vertical lanterns were chosen in preference to cold cathode vertical lanterns because of the lower initial cost. These vertical lanterns also harmonise with the decorative vertical lanterns which are being installed throughout the central area of the city at all tram and bus stops.

When the vertical lanterns are installed along the whole street, the special brackets on which they were mounted during the trial will be modified to meet criticism levelled on aesthetic grounds.



Trial installation at George Street, Edinburgh, and proposed modified bracket.

A cut-off sodium installation

A scheme for the Coseley Urban District Council on the Birmingham-Wolverhampton road covers about 3¼ miles, and comprises 340 lighting fittings suspended in pairs on steel catenary wires, supported by 25-ft. steel columns spaced at 105 to the mile. The Revo Street Lighting Department was responsible for the equipment and erection.

The lantern (Revo C.13660) uses one 140-watt sodium lamp and gives complete cut-off above the horizontal.

A sodium non-cut-off installation

Much to be commended by motorists on the A13 London to Southend Road is the recently completed sodium lighting installation at Pitsea and Vange which now form a part of the Basildon New Town.

The installation provides a high standard of lighting on one continuous stretch of road. Crompton Corona II lanterns are used with 140-watt lamps. Fifty lanterns were erected on Concrete Utilities type 3DNX columns, at an average spacing of 120 ft. All the equipment was installed by the North Midlands Engineering Co. Limited.

A Group B fluorescent installation

Fluorescent street lighting has recently been installed on a number of Group B roads in Portadown, Northern Ireland. B.T.H. 2-ft. lanterns, each housing two 40-watt lamps, are mounted at an angle of 45 deg. on 15-ft. Avenue 2D concrete columns.

Relighting of Northampton

In 1951 the Northampton Corporation decided to convert all their street lighting to electricity. Estimates showed that by adopting electric street lighting it would be possible to light the principal roads to Class A standard, provide 33 per cent. more lamps in the side streets, and ensure adequate all-night lighting throughout the town, without any increase in the annual charge to the Rate Fund (including loan charges) as compared with the costs of the existing system.

Demonstration three-lamp fluorescent lanterns were erected by the East Midlands Electricity Board, after which the first stage of 100 G.E.C. Three-Eighty lanterns and a small number of 500-watt tungsten lanterns mounted on Stewarts and Lloyds steel columns with tie bars were installed in the town centre in 1952 by the Board. The Corporation has now decided to use either three-lamp or two-lamp fluorescent lanterns on all the main roads throughout the town.

The contract received by The General Electric Co. Ltd. for Stage 2 included 58 Two-Eighty and 57 Three-Eighty lanterns; Stage 3 included 75 Two-Eighty and 139 Three-Eighty lanterns.

Last November work began on the largest stage of the contract, covering the remainder of the principal main roads extending to the borough boundaries. With the completion of Stage 4 of the conversion programme, 907 lanterns to Class A standard, and 51 to Class B will have been installed on 21 miles of the town centre and main traffic routes. Of these, 505 are three-lamp fluorescent, 369 two-lamp fluorescent, and 84 tungsten lanterns, the total capital cost being £57,300. The annual cost of maintenance and loan charges is £12,510 per year, and they replace 913 gas lamps which would have been costing £15,451 per year.

Erection work has been carried out by Clough, Smith and Co. Ltd., sub-contractor to the G.E.C., and servicing has been undertaken by the East Midlands Electricity Board of Northampton, who will be responsible for the future maintenance.

A main shopping street in Northampton

Installations of Aero-screened Lanterns

The first installations of the new G.E.C. aero-screened lanterns in the vicinity of airports are both in Scotland. One, at Renfrew Airport, Glasgow, is now complete; the other, near Aberdeen Airport, is nearing completion.

At Renfrew, where new terminal buildings have recently been opened to provide better reception and departure facilities for passengers, five lanterns housing 250-watt mercury lamps and mounted on Stewarts and Lloyds steel columns illuminate the car-parking area, which is only a few hundred yards away from the runway. Columns and lanterns harmonise well with the contemporary architectural treatment of the terminal buildings.

The new lanterns at Aberdeen are being installed in connection with housing development schemes at Northfield, Mastrick and Smithfield, which are within two miles of the boundary of the airport. Like those at Renfrew they house 250-watt mercury lamps. Altogether 180 lanterns on Springbank or Stanton prestressed concrete columns are involved in these schemes.

Aero-screened lanterns at Renfrew Airport

Sodium lighting on a bridge

Canada's second major sodium street lighting installation is now in operation along the new Angus L. Macdonald suspension bridge which spans the mile across Halifax Harbour between Halifax and Dartmouth, Nova Scotia. Sixty G.E.C. enclosed main road lanterns with auxiliary equipment and 140-watt sodium lamps were supplied by The British General Electric Co. (Canadian) Ltd.

The new bridge provides direct access between Halifax and Dartmouth for the one and a half million cars and five million pedestrians travelling annually between the two places. Previously access was by way of a ferry, or an overland route of 14 miles in length.

Colour-corrected mercury installation

The Calle Alcala in Madrid has recently been relighted using 1,000-watt colour-corrected mercury lamps. This road is one of the busiest in Madrid with a flow of over 4,000 vehicles an hour and considerable pedestrian traffic. The carriageway is 27 metres (approximately 90 ft.) wide. The lanterns are mounted at a height of 9 metres on existing trolley-bus standards 31 metres apart on each side of the road the lanterns being opposite one another. The average illumination on the road surface is 3 lm/ft^2; this is an increase of seven times over the previous illumination though the power consumption has been reduced by 40 per cent.

Notes on the City and Guilds Examination Papers

(4) Final Grade, Third Paper

By S. S. BEGGS, M.A., F.I.E.S.*

(1) *Give an account of the use of mixed high-pressure mercury vapour and incandescent filament lighting in interiors. Include a brief description, with sketches, of suitable equipment.*

The H.P.M.V. lamp has high luminous efficiency, but because of the line spectrum and the marked deficiency in long wavelength light, colours are distorted and complexions appear sallow. It is therefore not always acceptable for interior lighting to a high level of illumination. By combining the light from an incandescent filament with that from the H.P.M.V. discharge, light of a continuous spectrum rich in long wavelength light is added to that from the discharge, with a result acceptable for many purposes in industry. The "dual" lamp provides a combination of this form, but more often it is preferable to use the ordinary types of H.P.M.V. and filament lamps in separate fittings. Higher power sources can be used, and the proportions of H.P.M.V. and of incandescent filament light may readily be varied to suit one's wishes for different applications; the greater the proportion of H.P.M.V. light, the higher the luminous efficiency of the combination, but the greater the colour distortion. A very pleasant light is obtained by using about equal quantities of light of the two kinds, and a rather more efficient but still pleasant light is provided by combining lamps of about equal power.

The lamps may be used together in one fitting, but a more efficient arrangement is the use of separate fittings, each designed for the source with which it is used. In a general lighting scheme, the H.P.M.V. and the filament lamp units may be designed as two separate schemes intermeshed (with appropriate mounting height and spacing). However, to avoid noticeable variation in the proportions of light of the two kinds falling on different surfaces, and the colouration of shadows, there are advantages in having the fittings grouped together; this also helps in ease of access for maintenance.

Either vertically-burning or horizontally-burning H.P.M.V. lamps may be used. There is no significant difference in the coefficient of utilisation of the light if the fittings are suitable. Trough units are appropriate for the horizontally-burning lamp. Open reflectors are more usual than refractors, and they may be of either diffusing or specular material; the latter is preferable if they are for high mounting.

(*Note*: There are several types of fittings suitable for mixed lighting. See for example Trans. I.E.S. (London), Vol. 18, p. 15, 1953, and Vol. 19, p. 300, 1954. One or two sketches should be included in the answer.)

(2) *Describe, with sketches, the optical system of a 35 mm. cinematograph projector. What modifications are adopted to project pictures whose width/height ratio approaches two (e.g. "Cinemascope")?*

The principle of the optical system used in a 35 mm. cinematograph projector is shown in Fig. 7.

In order to obtain a high illumination of the screen, the objective lens O of the projector is usually wider than the picture on the film F and the "gate" aperture G which frames it. Therefore light from the source S (usually a carbon arc) is brought to a focus by the condenser lens C (which may alternatively be replaced by an ellipsoid mirror M with the source at one focus) at a point close to the gate G, as this will be the section of the beam of light of least diameter. The objective lens O is placed to form a greatly enlarged image P of the film picture on the screen,

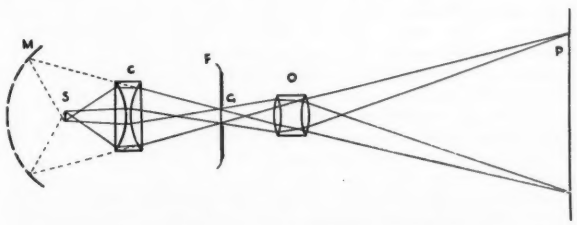


Fig. 7. Optical system of cinematograph projector.

the magnification depending simply on its focal length and the length of throw to the screen.

In order to enable a standard projector to project extra wide pictures, one device adopted is the use of a cylindrical lens (with axis of cylinder vertical) in front of the normal lens of the camera when taking the shot, so that a wider scene is imaged on the film (the negative picture being distorted by contraction laterally; a similar lens used in front of the normal objective lens of the projector restores the lateral angular width of the picture to that of the original scene.

(3). *Give a short account of the problems involved in designing motor-car headlights.*

The first problem is a specification of the light distribution in the beam required. Ideally the luminances of objects anywhere in the field of view should be reasonably similar, but this is far beyond possible achievement. Since in traffic glare to drivers of approaching vehicles must be kept to a minimum, the requirements for a "passing" beam are much more stringent than those for an open-road driving beam, and a compromise has to be accepted. In all cases high intensities are required over a small angle comprising the most important directions, with very rapid diminution of intensity over a few degrees; a small but very bright source is therefore essential, and a narrow-angle main projector system, such as a parabolic reflector. The permissible tolerances on the different parts of the optical system are small, and the light source must be located accurately in the projector. However, precise aiming of the projector on

* Research Laboratories of The General Electric Co., Ltd. Parts (1), (2) and (3) of this series, which is now completed, appeared in the July, September and October issues.

the car cannot be ensured and the direction of the beam will be affected by several factors, such as the loading on the car springs, tyre pressures and gradients or camber of the road; also the requirements for different road types, width or curvature will vary. Hence the beam must be designed to be satisfactory for a considerable range of variation of its training relative to the road.

Since the requirements of the " driving " and " passing " beams are so different, no compromise can make the same beam satisfactory for both. For simplicity, the " driving " beam may be redirected slightly downwards and towards the side of the road for " passing," or a fixed lamp with two filaments for use alternatively for the two beams may be used; in either case the compromise affects the beam distributions attainable, and the design of elements (usually prismatic) modifying the main beam distribution.

The headlights must be robust, of high precision, yet not costly. Since electrical power is limited, a deep reflector collecting most of the light flux from the lamp is the only practical form of projector. The reflector must have high specular reflection factor, and not deteriorate rapidly; " sealed beam " head lamps are excellent, but costly unless required in very great numbers. It is usually cheapest to use a symmetrical metal reflector and a thick moulded prismatic glass cover. The assembly must, of course, be vibration and weather proof, whilst access to the interior, for relamping, must not be difficult, and room may have to be provided for switches or solenoid operated tilting devices for changing the beam from " driving " to " passing " forms, and *vice versa*.

(4). *In a good-class departmental store, one section is devoted to ladies' dresses and coats. This section is* 150 *ft. long by* 50 *ft. wide, and is* 16 *ft. high. One shorter side is glazed and, apart from a* 10*-ft.-wide entrance, is used as a shop window. The other shorter end is divided into five open-ended cubicles, each* 10 *ft. deep, in which models are displayed. In the remainder of the space are counters and display stands.*

Suggest a system of lighting and a possible scheme of decorations for this shop, including the windows and cubicles.

(*Note*: A great variety of schemes could be put forward, any of which would be quite acceptable for the answer to this question. Some of the main considerations will be noted, and general suggestions made. For applications see for example Stevens's " Principles of Lighting," Chapter X; Trans. I.E.S. (London), Vol. 13, p. 226, and Vol. 20, p. 135; or almost any copy of *Light and Lighting*.)

The lighting and decorations must be designed to create a definite atmosphere; artistic quality is of as great importance as good engineering practice. Whilst a regular pattern of pendant fittings could be used for general lighting of the interior (provided they were not unattractive in appearance), this shows little imagination, and a less obvious arrangement would be preferable. A ceiling height of 16 ft. would permit of the use of a false ceiling and recessed fittings, or of indirect lighting from a moulding, or the tops of cupboards and stands; preferably this general lighting should not be obtrusive in itself, but should be of a fairly high level (15 to 20 lm/ft^2), as it is the main " working " light of the room.

Other lighting may be used for decoration, and additional light will certainly be required for the display areas, notably the cubicles at the far end of the room, to attract attention to them; for these the illumination should be from 50 to 100 lm/ft^2, but the modelling provided by the light is as important as its intensity. Concealed spotlights and reflector-type lamps are a very useful aid for this purpose. Strongly coloured light is not desirable, but cooler and warmer tones of white light might well be used in different cubicles, displaying for example morning frocks and afternoon or evening dresses. Coats will more often be worn outdoors than in (although ladies often retain their coats indoors at functions when men do not), so this section requiries light closer to daylight in colour than normal filament lamps provide. The combination of fluorescent lamps and filament lamps in suitable proportions is very effective.

If dresses or coats are stored in cases or covered racks, tubular fluorescent lamps just inside the front top of the case, and shielded from view, are useful for enabling articles to be picked out easily; a point to note is that whilst show cases should be provided with an illumination appreciably greater than that of the general lighting in the store, the ratio should not exceed about two or the difference in level will tend to make the colours appear dull or dark when the articles are removed from the case. Generally mirrors must be provided for the use of customers trying on garments, and the customer must be well lighted without glare when using one.

The area used as a shop window can be treated in a manner similar to that for the cubicles, but the lighting should be quite independent of that for the shop interior. Tubular fluorescent lamps may be used to provide general diffused lighting, and filament lamps in specular reflectors or spotlights to provide accent lighting and modelling; a combination of H.P.M.V. fluorescent lamps and filament lamps in reflectors of shop-window type is another very effective alternative. For certain high quality stores, a dramatic technique modelled on that of stage lighting may be preferable to one based on floodlighting; the whole scheme must strike the right note which it is intended should be associated with the particular store concerned.

(5). *Describe carefully the method of design of either;* (*a*) *a specular reflector, or* (*b*) *a prismatic refractor, for use with a* 500*-watt tungsten filament lamp to give a light distribution suitable for street lighting. Do not attempt to complete the design. State clearly the light distribution which the design is intended to produce.*

(*Note*: A very brief outline of the principles and procedure involved is given here, but in the examination the candidate should not attempt a general review, but take one specific example and pretend to work it out. Exact calculation need not be done, but likely values quoted—such as a mock table of corresponding inclinations of incident and reflected rays, and then of the inclinations of the tangents to the reflector contour, to illustrate the method. See for example Stevens's " Principles of Lighting," Chapter VI.)

The procedure is the same initially for either a specular reflector or a refractor, but the optical design is different.

Filament lamps of 500-watt rating are not often used now for street lighting except in the centre of small towns, because discharge lamps can be used more efficiently and are generally preferred unless the colour of the light is an important factor. The light distribution required (which should be sketched) will therefore probably be of non-cut-off type, with medium angle beam (See B.S. Code of Practice CP. 1004 : Part 1, 1952) or what was previously known as semi-cut-off. A suitable distribution would be slightly asymmetric, and have a maximum intensity at 70-75 deg. to the downward vertical. (For a town centre, the spacing of the lanterns would be relatively short, and a symmetric distribution might be permissible.) The 500-watt filament lamp emits about 8,000 lumens (average), and a likely light output ratio from the lanterns is 75 per cent.; a maximum intensity of about 2,500 cd. with a fairly broad distribution laterally should be the objective.

In designing the optical system, since the asymmetry is not great, the redistribution of light in the vertical plane and that over the conical surface through the maximum intensity may be regarded as substantially independent, i.e., the elements of a horizontal section of the reflector or refractor may be assumed to determine the conical distribution and those of a vertical section the distribution in the vertical plane (apart from any direct light from the lamp). There are several forms of fitting which would be suitable; for the distribution indicated a dome shape should be quite satisfactory.

To determine the redistribution of rays, the procedure is briefly as follows:—

(1) Subtract direct lamp intensities from the desired final

distribution. (2) Find the mean intensity over the remaining conical distribution; the ratio of the maximum intensity (without direct lamp light) to this intensity is the asymmetric magnification required from the reflector or refractor. (3) The curve of intensity distribution of redirected light in the vertical plane through the maximum, divided by this asymmetric magnification figure, gives the distribution to be provided by the vertical section of the unit (i.e., what a symmetrical unit of this section would give). (4) The total light flux in such a symmetrical distribution should equal that from the lamp falling on the optical elements (say from 80 deg. to 140 deg. from the downward vertical) less losses in the system, for which a reasonable allowance would be 20 per cent. (5) In a reflector the ray from the lower edge will emerge at the highest angle, whilst in a refractor the ray from the lower rim will emerge at the lowest inclination at which augmentation of the direct lamp light is necessary. (6) Starting with these corresponding limiting rays, the directions into which other rays from the lamp at convenient intervals (say 10 deg. zones) have to be redirected can be calculated from the intensity distributions of the bare lamp and of the required redistribution, since the product of solid angle of zone and mean intensity (giving flux) must be the same for corresponding zones, after allowance for losses at reflection or refraction. A table of corresponding inclinations to the vertical of incident and redirected rays can thus be prepared.

In designing the section of the reflector or refractor required, a suitable maximum diameter is selected (say 12 in. to 14 in. for a reflector and not quite so much for a refractor); this locates the lower rim, since the inclination of the ray to this point has already been chosen as 80 deg. (Sometimes the neck diameter is specified, in which case a start may be made at the upper edge.) The contour of the reflector, or the inclination of the prism faces on a dome contour, can be calculated by the ordinary laws of optics from the tabulated inclinations of corresponding incident and redirected rays. The section can then be drawn.

The horizontal section can be determined from the required conical distribution in a similar manner (except that zone factors are not required, since one is concerned with angles in azimuth and not in elevation); a non-circular contour for the reflector or a set of prism angles for a circular dome refractor is thus obtained. (A simpler alternative for the reflector is to use the properties of known geometrical profiles, such as the ellipse, to obtain the asymmetry.) A suitable lip or other locating and supporting means may be required.

(6). *What are the principles governing the choice of light distribution of an airport runway light? Describe briefly one such light.*

The pilot may be brought to within about a mile from the airport by radio aids, but he must *see* to be sure of making a safe landing. Approach lights guide him to the threshold of the runway, and the runway lights must be visible from at least the perimeter of the airport on a normal line of approach.

Runway lights are limited in electrical power, and if required for use in conditions of bad visibility an asymmetric distribution is necessary, in which a relatively narrow beam is approximately aligned with the direction of the runway. The maximum intensity provided should be as high as compatible with other requirements, for use in bad weather. (If also used in good weather this may be reduced, for example by dimming the lamp, to avoid glare to the pilot.) At present a usual lamp rating is 36 watts for flush lights and 100 watts for elevated lights, with which a maximum intensity between 5,000 cd. and 10,000 cd. may be achieved with a flush type and about thrice these intensities (and a wider beam) with elevated lights.

If the aircraft is making a good approach on the correct glide path, it descends at an inclination of about 3 deg., so the maximum intensity of the runway light should be directed at about this angle above the horizontal plane through the fitting. The nearer lights visible to the pilot (and in bad weather probably the only ones) are only a few hundred feet ahead, so on a wide runway the maximum intensity may be turned slightly inwards from the axial line, by about 2 or 3 deg. (Both these angles of elevation and azimuth should be adjustable over a small range to suit the requirements of individual airports.)

The pilot requires to see the runway lights from as soon as he can detect them until they disappear below the cut-off of his vision of the ground by the aircraft itself; also allowance has to be made for the approach not being quite centrally down the runway, or not quite on the correct glide path, as well as a small tolerance on setting up the lights. A beam spread of about 10 deg. both vertically and horizontally is therefore required; if higher wattage lamps may be used, the lateral width may be increased with advantage, up to about 20 deg. Both uni-directional and bi-directional lights are in use, the present trend being rather towards the former.

Runway lights intended for use only in fair weather need to provide a very much lower intensity (of the order of 100 candelas), and it is then an advantage to make the distribution symmetrical about the vertical; since the lights may be visible from a considerably greater distance than is practicable in bad weather (because of the higher atmospheric transmission) the lay-out of the runway is clearly seen from the air. (This is particularly helpful if aircraft have to circle the airport, awaiting permission to land, for example at a busy period.) Little light is required above about 30 deg. elevation, since normally the aircraft cuts off view of the lights at these steep angles.

Minimum requirements for the light distribution of a runway light have been agreed internationally, and British recommendations are given in B.S.1332: 1952.

(*Note*: Quite a variety of designs of fittings exist, any of which may be used for the answer to this question. See for example Stevens's "Principles of Lighting," Chapter XIV, and references quoted there.)

A simple but very effective form of elevated high intensity runway light consists simply of a deep parabolic reflector, made of aluminium of high specular reflectivity, with a fluted cover-glass, the flutes lying in vertical planes. This design gives a beam of relatively small divergence in the vertical plane (determined mainly by the focal length of the reflector and the dimensions of the light source), and a wider spread in the horizontal plane (produced by the shallow flutes). The unit is mounted on a base plate by a short stem, which incorporates a weak link (and disconnector) so that the fitting collapses easily if accidentally struck by an aircraft at speed, and does not present a serious obstacle.

(7). *Plan the lighting for the following open space. The civic centre of a town is* 100 *yd. square. It is surrounded on all sides by (white) Portland stone-faced buildings* 50 *ft. high, except at the four corners where roads enter along the lines of the diagonals: these roads are* 30 *ft. wide with* 10-*ft. pavements. The pavements around the square are* 30 *ft. wide, the roadway* 45 *ft. wide, and in the centre is a square of* 150-*ft. side laid out as gardens with paths and seats. The lighting is intended to enhance the appearance of the square and should not be entirely utilitarian. Show, with the aid of sketches, the equipment to be used.*

In a civic centre of this nature light should be plentiful, so that vision of objects is direct and not by silhouette (except in the approach roads); and light should be allowed to fall on the buildings, which clearly form an important feature of this area and (being light in colour) will show up well. The colour of the light should be pleasing, and high efficiency of light output is desirable economically.

(*Note*: One possible scheme will be described as an example, although there are many alternatives.)

Tubular fluorescent lamps of daylight colour, mounted vertically in fluted or diffusing cylindrical lanterns (Fig 8(a)), would be suitable, and they might well be of cold cathode type. Two lanterns, each containing lamps of about 400 watts total power, should be mounted at 25 ft. height, 5 ft. from the edge of the wide pavement and about 120 ft. apart

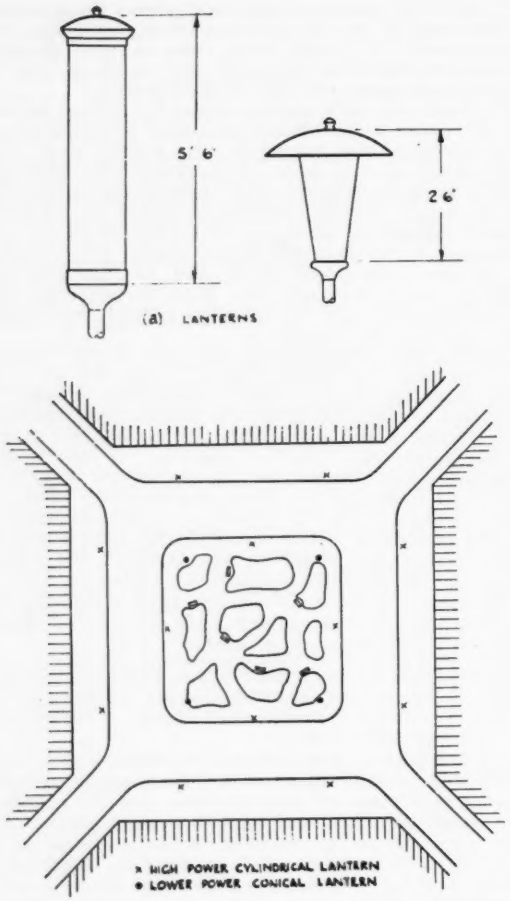


Fig. 8. Proposed lanterns and lay-out of civic centre.

on each side of the square; a similar lantern should be placed at the centre of each side of the central square area (see Fig. 8 (b)).

Close to each corner of this central area a smaller lantern of somewhat similar type (see Fig. 8 (a)) using four 2-ft. 40-watt lamps, and mounted on a shorter column (at about 20 ft.), would provide additional light in the region of the road junctions and corners (which form the danger spots) as well as being a helpful source to traffic approaching along the entering roads.

The lighting of the gardens would be adequate, and the colour of the plants and shrubs natural. Although the initial cost might be a little high, the appearance of this civic centre would be very attractive.

(8). *Calculate the maximum theoretical illumination which can be achieved under an installation of 5-ft. 80-watt tubular fluorescent lamps, stating clearly the assumptions made and proving the formulae used.*

The maximum illumination will be obtained when light reaches the point in question from all possible directions; it can come only from lamps, images of lamps, or the surface of reflectors of which the luminance can never exceed that of the source. Hence the illumination will be a maximum when the point receives light from apparently a complete hemisphere of "sky" of luminance equal to that of the fluorescent lamp.

(*Note* : The derivation of the illumination received from a diffusing hemisphere of constant luminance is standard bookwork—see for example Stevens's "Principles of Lighting," p. 12. However, an alternative derivation not involving calculus is given below.)

The intensity of a small area a sq. ft. of luminance B ft.-lamberts (i.e. $\frac{B}{\pi}$ cd./sq. ft.) in a direction making an angle θ with the normal to the area is $\left(\frac{Ba}{\pi}\cos\theta\right)$ candelas, and the illumination it gives at a point on a plane at distance r ft. on which the light is incident at an angle ϕ is $\frac{Ba}{\pi}\cos\theta.\frac{\cos\phi}{r^2}$ lm/ft². If the small area a is part of a hemisphere of which the point is the centre of the plane base, θ is zero, r is the radius of the hemisphere and ($a\cos\phi$) is the projection of the small area on to the base plane. The total illumination from the whole hemisphere is therefore given by the product of the constant factor $\left(\frac{B}{\pi r^2}\right)$ and the area of the projection of the complete hemisphere on the base plane, viz. (πr^2); this illumination is therefore B lm/ft².

Assuming that the fluorescent lamp is of uniform luminance B ft.-lamberts at all points of its surface, the maximum illumination at the point will be B lm/ft².

Now the maximum light output of a 5-ft. 80-watt lamp is about 4,000 lumens, and its light emitting surface has approximately length 5 ft. and diameter 1½ in., so that its surface area is $5 \times \pi(\frac{1}{8})$ sq. ft. Its luminance is then $\frac{(4{,}000 \times 8)}{5\pi}$ ft.-lamberts, i.e. approximately 2,000 ft.-lamberts. The *maximum* illumination obtainable with an installation of such lamps is therefore about 2,000 lm/ft².

Book Review

"Light Calculations and Measurements," by H. A. E. Keitz. Philips' Technical Library (distributed by Cleaver-Hume Press Ltd.); pp. xvi + 413; 238 figs: Price 52s. 6d.

More and more is it becoming essential for the lighting specialist to understand the theoretical basis of his methods and calculations; rule of thumb is not sufficient. This book should, therefore, serve a really useful purpose. The practising lighting engineer may feel that the material is too theoretical or "laboratory" for his needs, but those concerned with photometry should certainly be conversant with it; it should be particularly helpful to candidates for the City and Guilds Final Grade examination.

The book is divided into two parts. In the first part the author discusses the concepts, laws and relationships of photometric quantities, and derives the formulae that have application in photometric calculations; in the second the methods of photometry are described, with special reference to their theoretical basis. The field covered is a definite and limited one, but it has been treated fully and clearly. The viewpoint is that of photometry, and the treatment is based on the "point source"; although luminous flux is the initial concept, the author places great emphasis on an understanding of solid angle and follows largely the standard procedure based on luminous intensity. Several of the terms and procedures refer to Continental rather than British practice, e.g., the Hefner candle receives more attention than it merits, and the only flicker photometer described is the Bechstein pattern. Unfortunately the footcandle is named categorically as the unit of illumination based on the foot, and the definition and use of luminous emittance to include illumination may lead to confusion, whilst remission of light sounds strange in our ears. However, although one may disagree with some of the details, the general treatment is excellent. The chapter on the Properties of Optical Systems—not usually considered in books on lighting—is particularly to be welcomed, and should help to remove much of the prevalent confusion of ideas on this subject. Whilst it will be of most use to those who work in the photometric laboratory, this book can be strongly recommended to all who wish to have a better understanding of the basic principles of the photometric system.

S. S. B.

I.E.S. Activities

Presidential Address

At the opening meeting of the new session of the I.E.S., held at the Royal Institution on October 11, Mr. A. G. Higgins took office as president. In his presidential address Mr. Higgins dealt with the importance of the work of the Society to the ordinary citizen. In the latter part of his address he discussed possible future developments of the Society.

Mr. Higgins said that as the Society is interested in all aspects of lighting and of seeing it must therefore be concerned with matters which vitally affect the ordinary citizen. In the first place the greater part of people's working life is spent under conditions of natural lighting, a subject to which considerable attention has been devoted by many prominent members of the Society. The work that has been done by the Society is summarised in Part III of the latest edition of the I.E.S. Code.

The citizen also spends many hours of his life under conditions of artificial lighting and it is interesting to consider the tremendous benefits which are bestowed upon him by reason of the remarkable developments in lighting technique during the last two decades.

In the home it is unfortunately true that the situation is far from satisfactory; a survey made on a number of dwellings of the lower income groups revealed that the quantity of artificial light employed is in general well below the standards recommended by the Society. It was obvious that more education is needed in this direction. Many modern developments in lighting are not, however, available to the large number of people living in dwellings owned by local authorities who, for reasons of economy, supply only the bare essentials of lighting. The usual provision is a point in the centre of the ceiling and one on a skirting board, the latter all too frequently being monopolised by radio or television. If the tenant wishes to provide himself with better lighting he is faced with considerable capital outlay which he is reluctant to undertake on property which is not his own. Further, he is frequently precluded by the terms of his tenancy from channelling the walls to install additional outlets. Local authorities must, of course, protect their property from damage; it is clear, however, that in the domestic field the citizen is not always able to take full advantage of developments in lighting technique.

In the field of his work the citizen has been able to derive greater benefit, e.g., in the case of industrial lighting the advantages of modern light sources have been exploited to a marked degree. The Society has provided a platform for many excellent papers on the lighting of factories and on seeing conditions in industry. There are no doubt many factories where the lighting is still of a lower order than the Society deems desirable, but there can be no doubt that the work of the Society during the last two decades is rapidly bearing fruit and that there are thousands of workers employed in factories enjoying a high standard of lighting as a result of the Society's activities.

It is a curious anomaly that while workers in factories are to some extent cared for by Statutory Instruments and Regulations no such provision has yet been made to ensure adequate lighting for those working in offices. It is reported, however, that the Government intends to introduce legislation relating to conditions of employment in various non-industrial occupations which will no doubt include lighting.

Since the war there has been a general tendency for working hours to be shorter and for citizens to enjoy longer periods of leisure. The part that lighting has played in enabling them to make the most of that leisure is considerable; in the fields of entertainment and sport the lighting engineer has been able to exploit as fully as anywhere the science and art of his profession.

In the lighting of schools and street the Society has also taken an active interest, and present-day standards, although there is still room for improvement, are very much higher than those enjoyed by our forbears.

So in his work and in his play the work of the Society and the rapid progress in lighting techniques has had a profound influence upon the ordinary citizen. The Society may rightly be proud of its contribution to our national life and may feel with justification that the objects for which it was founded are being amply fulfilled. The Society, however, has established not only a right but, what is more important, a responsibility to continue and to increase its contribution to the well-being of the public. Conditions prevailing to-day are different from those which operated when the Society was founded in 1909. It may be necessary for the Society to cast its net wider and to bring into its deliberations and discussions more people who do not regard themselves as illuminating engineers but whose activities are closely associated with lighting. It may even be considered that the present title of the Society is not altogether appropriate as so many people who are concerned with lighting and seeing would hesitate to describe their work as "engineering."

At the same time the Society must continue to give careful attention to the training of lighting engineers and to the designation or qualification awarded to those who reach a certain standard of professional ability. It would seem that the Society's first attempt to satisfy the requirements of its professional members by means of a Register of Lighting Engineers does not entirely meet the case. Whatever the outcome may be the status which the qualification eventually achieves will depend on the degree of its acceptance by the lighting industry and by users generally. The Society would like to see all employers of lighting engineers do all in their power to encourage their staffs to acquire the qualification to assist them in their training and to recognise the qualification as an essential requisite for those engaged in the various spheres of lighting practice. The lighting industry would thus help to ensure that the Society's qualification, whatever name it is eventually given, would achieve the recognition that is undoubtedly its due.

Birmingham Centre, 1955-1956

The opening meeting of the Birmingham Centre for the 1955-56 session was held at Regent House, St. Phillip's Place, Birmingham, on Friday, September 23, when the new chairman, Mr. G. R. Hanson, was duly installed.

As Mr. Hanson has been associated with the textile industry for many years it was natural that his address should deal with this industry. Owing to the breadth of the subject Mr. Hanson confined himself in the main to the woollen and worsted industry. He began with a few remarks dealing with the historical aspect of spinning and textiles in general and followed this with a film giving a very lucid commentary

on all aspects of the woollen industry from shearing to the production of the final cloth.

Following this Mr. Hanson showed a number of slides in black and white dealing with the various aspects of lighting some of the complicated and extremely large pieces of equipment used in the spinning industry, and he explained how after much experiment and experience desirable forms of lighting from the operative's point of view were finally arrived at.

The outgoing chairman, Mr. F. W. Haynes, was warmly congratulated for his services in the past year by Mr. Hanson and representatives of the committee, and the meeting in general.

Leeds Centre

A repeat of the third Trotter-Paterson Memorial Lecture entitled "The Brightness of the Stars" was given by Sir Harold Spencer Jones, Astronomer Royal, at Leeds University on Monday evening, September 26, when an audience of 280 were present. The meeting was widely representative of many interested organisations and was held under the chairmanship of Mr. J. R. Bardsley, the Leeds Centre chairman.

Sir Harold dealt with methods of computing and measuring the brightness of the stars and the applause which followed his address was a clear indication of the appreciation of those present.

Amongst the audience were members and staff of Leeds University, the Royal Astronomical Society, kindred bodies and students.

I.E.S. Forthcoming Meetings

LONDON

November 8th

Sessional Meeting. "Efficiency of Fluorescent Lamps," by F. Jackson, R. Molloy, and K. Scott. (At the Lighting Service Bureau, 2, Savoy Hill, W.C.2.) 6 p.m

November 22nd

Lecture. "Ship Lighting," by T. Catten. (At the Lighting Service Bureau, 2, Savoy Hill, W.C.2.) 6 p.m.

CENTRES AND GROUPS

November 2nd

EDINBURGH.—"Artificial Lighting for Plant Growth," by A. E. Canham. (At the Y.M.C.A. Small Hall, 4, Queen Street, Edinburgh.) 6.15 p.m.

MANCHESTER.—Annual Dinner. (At the Café Royal.)

SWANSEA.—"Problems of Production Lighting in Television Studios," by R. de B. McCullough. (At the South Wales Electricity Board's Demonstration Theatre, The Kingsway, Swansea.) 6.30 p.m.

November 3rd

CARDIFF.—"Problems of Production Lighting in Television Studios," by R. de B. McCullough. (At the South Wales Electricity Board's Demonstration Theatre, The Hayes, Cardiff.) 5.45 p.m.

GLASGOW.—"Maintenance of Lighting Installations," by J. W. Strange and W. Robinson. (At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2.) 6.30 p.m.

NOTTINGHAM.—"Lighting of Hazardous and Corrosive Locations in Industrial Plants," by W. E. Harper and A. G. Palmer. (At the Demonstration Theatre of the East Midlands Electricity Board, Smithy Row, Nottingham.) 6 p.m.

November 7th

LEEDS.—"Some Developments in Fluorescent Lighting," by H. H. Ballin. (At the Lecture Theatre of the Yorkshire Electricity Board, Ferensway, Hull.) 7 p.m.

November 9th

LEEDS.—"Modelling with Light and Colour," by J. W. Howell (Vice-President). (At the Y.M.C.A. Lecture Theatre, 16, John William Street, Huddersfield.) 7 p.m.

NEWCASTLE.—"The Architect's Approach to Artificial Lighting Design," by G. Grenfell Baines. (At the Large Lecture Theatre, Greay Hall, Department of Electrical Engineering, King's College, College Road, Newcastle-upon-Tyne, 1.) 6.15 p.m.

November 10th

BIRMINGHAM.—Ladies' Night. (At the Botanical Gardens Ballroom, Westbourne Road, Edgbaston.)

November 14th

SHEFFIELD.—"Interior Decoration and Lighting," by J. Wilson. (At the Medical Library, The University, Western Bank, Sheffield, 10.) 6.30 p.m.

November 15th

GLOUCESTER AND CHELTENHAM.—"Prescribing for Seeing," by M. L. Berson. (At the Fleece Hotel, High Street, Cheltenham.) 6.30 p.m.

November 16th

LEEDS.—"Modelling with Light and Colour," by J. W. Howell (Vice-President). (At the Lecture Hall, Church House, North Parade, Bradford.) 7 p.m.

NORTH LANCASHIRE.—"Shop Window Lighting," by R. L. C. Tate. (At the Demonstration Theatre of the North-Western Electricity Board, 19, Friargate, Preston.) 7.15 p.m.

TEES-SIDE.—"Contemporary Lighting," by K. S. Morris. (At the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough.) 6.30 p.m.

November 17th

MANCHESTER.—"Shop Window Lighting," by R. L. C. Tate. (At the Demonstration Theatre of the North-Western Electricity Board, Town Hall Extension, Manchester.) 6 p.m.

November 21st

LEEDS.—"Prevention of Blindness," by G. Black. (At the E.L.M.A. Lighting Service Bureau, 24, Aire Street, Leeds, 1.) 6.15 p.m.

November 22nd

LIVERPOOL.—"Studies in Interior Lighting," by J. M. Waldram. (Joint meeting with the A.S.E.E.) (At the Liverpool Engineering Society, 9, The Temple, Dale Street, Liverpool.) 6 p.m.

November 23rd

TRANSVAAL.—"Home Lighting," by R. S. Yates. (At Room 95, Public Library, Johannesburg.) 8 p.m.

November 25th

BATH AND BRISTOL.—"The Maintenance of Lighting Installations," by A. D. S. Atkinson. (At the South-Western Electricity Board, Old Bridge Street, Bath.) 7 p.m.

BIRMINGHAM.—"Germicidal Radiation," by D. H. Holloway. (At "Regent House," St. Phillip's Place, Colmore Row, Birmingham.) 6 p.m.

CARDIFF.—Annual Dinner Dance. (At St. Mellons Country Club).

LEICESTER.—Social Evening. (At the Coronation Hotel.)

Correspondence

Lighting Terms

To the Editor, LIGHT AND LIGHTING.

Dear Sir,—It is observed that the term "Maintenance Factor," as referred to in British Textbooks and commercial literature, allows for depreciation of lighting fittings and of reflection factors of room decorations only. The definition of this term in B.S. 233 is followed by a note which states that—"This factor includes deterioration from all causes, e.g., in the output of the lamp, the dirtying of the fitting and deterioration of the room decoration." In order to avoid confusion in interpretation it is suggested that the relevant factor employed in design calculations which are based upon the "A.T.L." outputs of lamps, should be redesignated "Dust Factor."

Another term which appears to have two usages is that of "Angle of Cut Off." Although it is defined in B.S. 233 in terms of the angle from the lower vertical, references in commercial publications are usually in terms of an angle below the horizontal.—Yours, etc.,

London. J. B. HARRIS.

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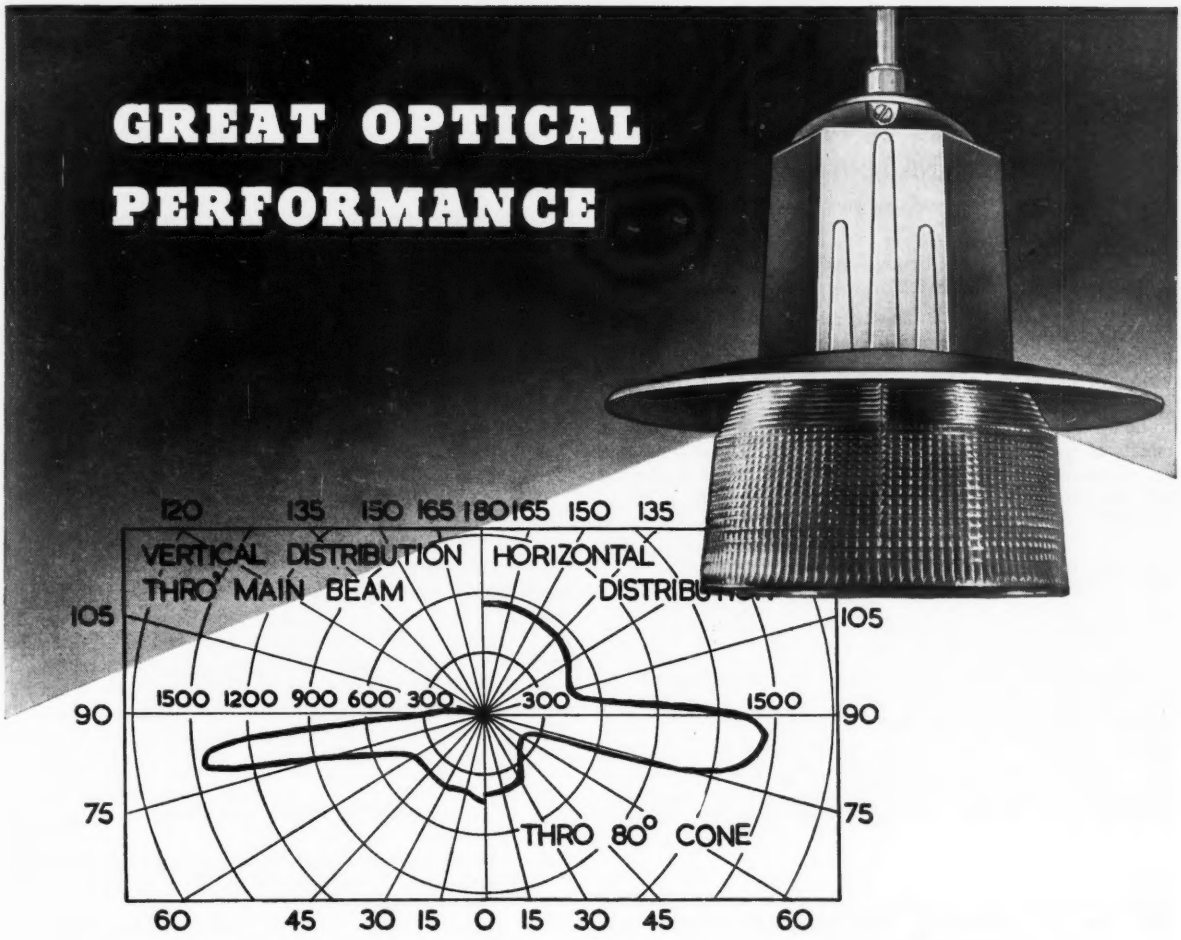

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Here are some of the reasons why :

1. The lantern is made in only 3 main parts : die-cast aluminium body ; the lamp holder bridge assembly ; dome type refractor.
2. The refractor and focal position stops are cast with the body.
3. The lamp holder bridge and lamp holder can be removed by loosening focal stop screws and turning slightly.
4. Single piece glass dome refractor (available for axial or non-axial distribution) gives maximum light control and high output.
5. The refractor is firmly held in correct relation to the body, by solid internal spring loaded clips.
6. These springs are enclosed within the body casting—completely protected from the weather.

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Lighting Abstracts

OPTICS AND PHOTOMETRY

612.843.31

218. Colour and seeing.

H. HELSON. *Illum. Engng.*, **50**, 271-278 (*June*, 1955).

The apparently conflicting results which have been obtained by different investigators studying various visual functions (e.g., acuity, performance, colour appearance, etc.) with illuminants of different spectral energy distributions is thought to be partly explained by the differences in colour vision of individual subjects and the influence of the background on adaptation level. The proper choice of illuminant to be used with different object colours is emphasised and the effects of source colour on acuity and other visual functions are discussed. For specific visual tasks light sources having optimum spectral energy distributions can be used. P. P.

535.24

219. Accuracy of the Macbeth Illuminometer as a function of operator variability, calibration, and sensitivity.

A. MORRIS, F. L. MCGUIRE AND H. P. VAN COTT. *J. Opt. Soc. Amer.*, **45**, 525-530 (*July*, 1955).

In order to assess the accuracy of this instrument in practical use measurements were made on a surface of known brightness by a number of different observers. The results of these measurements are presented and analysed. The effect of errors in calibration and the precision limit set by the contrast threshold of the eye were also examined. Conditions for the best use of the instrument are discussed. E. J. G.

612.843.6

220. Use of performance data to specify quantity and quality of interior illumination.

H. R. BLACKWELL. *Illum, Engng.*, **50**, 286-299 (*June*, 1955).

Data previously reported by the author on a number of physical factors which determine visual performance in a uniform visual field have been smoothed to give curves relating speed and accuracy with quantity of illumination. The data have been extended to a non-uniform visual field in which the disabling glare sources are assumed to introduce a veiling luminance whose magnitude can be computed by an empirical formula. Detailed curves are given for a veiling luminance one-half the field luminance. Comparisons between the present data and those of Weston and Moon and Spencer are made. The discrepancy with Weston's results is believed to be due to the time-loss involved in scanning Weston's Landolt rings. The discrepancy with Moon and Spencer's "Delos" method is believed to be due to the different concept of "performance" used by these investigators. P. P.

612.843.31

221. Colour-rendering of fluorescent lamps and binocular viewing investigations.

G. T. WINCH AND B. M. YOUNG. *Illum. Engng.*, **50**, 353-360 (*July*, 1955).

The factors which determine the subjective colour-rendering properties of a lighting installation are listed and are shown to include both the objective colour-rendering properties and the conditioning of individual observers. The "red-ratio" and C.I.E. chromaticity and spectral band methods of specifying objective colour-rendering properties are discussed and comparisons are made between a number of proposed divisions of the visible spectrum. The authors' binocular viewing method for studying subjective colour-rendering properties is briefly described along with some of the results. A method is given which enables photovoltaic calls to be used to measure chromaticity and spectral bands. P. P.

535.243 : 621.327.43

222. Spectrophotometry of fluorescent lamps by the use of filters

E. ROHNER. *Bull. Assoc. Suisse Elect.*, **46**, 567-571 (*June*, 1955). *In German.*

Examines the possibility of determining the spectral distribution curves of fluorescent lamps by the use of a limited number of interference filters. Such filters have transmission bands some 30 to 40μ in width. Two photo cells with partially complementary spectral sensitivity curves can be used and with such a combination and a set of 10 filters the spectral distribution curves of a number of fluorescent lamps were determined and the results compared with those obtained by spectrophotometry. If the filters are carefully selected, excellent agreement can be obtained with relatively simple apparatus. J. W. T. W.

LAMPS AND FITTINGS

621.327.4

223. The mechanism of light emission in crystal phosphors.

G. GUNTHER. *Ljuskultur*, **27**, 42-49 (*April-June*, 1955). *In Swedish.*

A general article on the solid state in relation to luminescent crystals. The rôle of the activator is discussed with the aid of the familiar energy-level diagrams. R. G. H.

621.327.4

224. High pressure Xenon lamps of high luminance and luminous intensity.

K. LARCHE. *Lichttechnik*, **7**, 221-224 (*June*, 1955). *In German.*

Gives a general description of the characteristics of the high-pressure Xenon lamp now available in two types, the short arc with five ratings from 150 to 2,000 watts and the long arc, with water cooling, rated at 6,000 watts and with or without mirror backing. The former are best operated vertically, anode up, on d.c., except for the 150-watt which can be used also on a.c. A table of values of luminance and luminous intensity is given and there are a number of polar curves (the legend to Fig. 9 is incorrect). Spectral distribution curves for the two types are shown and the colour co-ordinates are given. J. W. T. W.

LIGHTING

628.97

225. Some new results from (plant) lighting studies at Weibullsholm.

O. GELIN. *Ljuskultur*, **27**, 38-41 (*April-June*, 1955). *In Swedish.*

For several years an investigation has been conducted into the use of fluorescent and other lamps (H.P.M.V., mixed

H.P.M.V. and filament) for accelerating the growth of plants. The results have been very encouraging in favour of a fluorescent lamp system, which produces 300-400 lm/ft². It has been shown that the use of such a system of supplementary lighting is an economic proposition in the raising of lettuces during winter. R. G. H.

628.972

226. Teachers' opinions of school lighting in Stockholm.

U. HJARNE. *Ljuskultur*, **27**, 25-28 (*April-June*, 1955). *In Swedish.*

A questionnaire was circulated to a number of schools in which classrooms were lit either by fluorescent lighting alone, or by fluorescent lighting over the teacher's table and the chalkboard and filament lighting over the children's desks. Where fluorescent lighting alone is provided, 91 per cent. of 434 teachers who replied were satisfied, 9 per cent. dissatisfied with the lighting. For mixed lighting the figures were 82 per cent. and 18 per cent. respectively. Of 226 teachers who had experience of both systems, 59 per cent. preferred all-fluorescent, 41 per cent. mixed lighting. Twenty-six per cent. of 516 wished for a warmer colour for the fluorescent lighting, the other 74 per cent. asked for no change. Eighty-four per cent. of 618 considered filament lighting alone inadequate. (The forms of the questions to some extent determined the nature of the answers: *Abs. note*). There were many detailed comments reported, including complaints of bad starting and flicker, and of ballast hum, with fluorescent lighting. Sixty-seven teachers expressed a wish for a table lamp on their own desk. Glare due to inefficient screening was another source of complaint.

In general the report gives approval of fluorescent lighting in classrooms qualified with a desire for better engineering and maintenance, and with special attention drawn to the noise of the ballasts and to glare and flicker.

R. G. H.

628.93 : 612.843.367

227. Quality of lighting.

S. K. GUTH. *Illum. Engng.*, **50**, 279-285 (*June*, 1955).

Comparisons are made of the results of discomfort glare studies conducted in recent years by Vermeulen and De Boer, Luckiesh and Guth and Petherbridge and Hopkinson. These results are tending to supercede those obtained by Holladay, on which the specification of 3 : 1 brightness ratios for quality in lighting was originally based. Methods for calculating comfort ratings are discussed, including the Glare Rating Method, the BCD Method and the Logan-Lange Method. The Visual Comfort Index which rates glare discomfort in terms of the percentage of comfortable observers is advocated as a numerical rating having greater significance than others that have been previously used.

P. P.

628.93

228. Environment in seeing.

L. C. KALFF. *Illum. Engng.*, **50**, 319-328 (*July*, 1955).

Application of the results of glare studies to the design of the environment is primarily directed towards the reduction or elimination of visual discomfort. The end-point is not necessarily the positive sensation of seeing-comfort, whose achievement depends on the correct combination of lines, coloured surfaces and brightnesses in the field of view. Line-colour-brightness schemes which take into account the operation of the visual mechanism are proposed and have been demonstrated in an experimental room. Old masters and the architecture of building interiors are shown to conform to the principles of these schemes. P. P.

628.9

229. Lighting as a factor in the economy of electricity supply.

M. ROESGEN. *Bull Assoc. Suisse Elect.*, **46**, 556-558 (*June* 11, 1955). *In French.*

At first lighting was the principal load on central stations; lamp efficiences were low and the cost of power high. Before and after the First World War electric lighting expanded rapidly, efficiencies increased and costs were lowered. By 1930 the cost per lumen-hour had been reduced to one-twelfth of what it was at the beginning of the century. The introduction of metering caused a set-back in consumption and then came the high efficiency discharge lamp and, later, the fluorescent lamp. Fears of loss of revenue proved groundless as illumination values were raised. The introduction of two-part tariffs was expected by some to cause a loss of revenue, but two factors reduced this risk, viz., the fact that lighting is no longer the major load and the effect of propaganda in continuing to raise lighting levels. J. W. T. W.

628.971

230. Automobile lighting.

C. SAVOIE. *Bull. Assoc. Suisse Elect.*, **46**, 564-567 (*June* 11, 1955). *In French.*

Describes the investigations carried out since 1951 under the auspices of the C.I.E. and the International Standards Organisation and explains how these bodies have collaborated in an attempt to arrive at international agreement on the lights carried on an automobile, more especially the driving light, the passing light and the fog light. The second has given rise to most discussion, chiefly because of the differences in practice in Europe and the United States. The tests made in various countries, leading up to international tests at Detroit, are described. J. W. T. W.

628.92

231. Accuracy of daylight predictions by means of models under an artificial sky.

B. H. REED AND M. A. NOWAK. *Illum. Engng.*, **50**, 336-346 (*July*, 1955).

Preliminary comparisons between measurements of daylighting in models used with an artificial sky and ground and in full-scale rooms used with a natural sky and ground gave discrepancies which were found to be due to the different sky and ground conditions prevailing on the two occasions. A theoretical study showed that when the illumination indoors was related to that simultaneously occurring on a vertical plane outdoors, then the ratio of the two illuminations depended on the relative amounts of light received on the vertical surface from the ground and the sky. Further measurements confirmed this finding and demonstrated that "daylight factor" as defined gave the best agreement between model and full scale studies under a variety of sky and ground conditions. P. P.

628.971

232. Platform lighting with cold cathode fluorescent lamps.

W. GRUBER. *Bull. Assoc. Suisse Elect.*, **46**, 571-572 (*June* 11, 1955). *In German.*

Describes the new installation at Zurich-Enge station. The cold cathode tubing follows the line of the platform, under the canopy, and is some 4 ft. rearwards of the edge. The light output is 210 lm per foot and the current 95 mA. The illumination was found to be 1.5 to 2 lm/ft² for a 10 ft. depth of platform before the canopy was painted and double this value after painting. A night photograph is given.

J. W. T. W.

POSTSCRIPT By "Lumeritas"

A fellow columnist, who writes in a provincial newspaper under the *nom de plume* "Hawtune," has recently published a definition of the term "foot-candle" which may be of interest to those who still think that "foot-candle" is preferable to "lumens per square foot" because it is more easily understood. Writing about a new floodlighting installation at a sports ground in his native town, Hawtune says "it is quoted as being of a power of 10 foot-candles." Then, says he, "For the benefit of the uninitiated, a foot-candle is the amount of light over a square foot of ground, measured at a height of one foot above ground." He compares the "strength" of some new street lighting in the town with that of the sports ground lighting, which he says is 40 times stronger. Anyone who doubts this statement and happens to possess a foot-candle meter is invited to check it by standing in the newly lighted street with the meter a foot above the ground, noting if it measures a quarter foot-candle, and then rushing up to the sports field to take a similar measurement there. It is not clear from the writer's remarks whether the foot-candle meter is to be exposed to the square foot of ground but that seems to be the idea.

As the theme of this issue of the journal is street lighting it is interesting to note that this subject has lately figured in many provincial newspapers. Undoubtedly there is widespread interest in the lighting of streets and no little controversy about illuminants, lanterns and lighting columns. My impression is that the general public is more "choosey" about these things than heretofore. And experience of the excellent new lighting in many town centres and on main traffic routes is making people want more of a good thing. For instance, it is reported that new lighting standards for the main streets of Exeter "have resulted in a great awakening of the citizens" to the desirability of better street lighting. "Everywhere, it seems, there is a spontaneous surge of requests for better illumination. People living in the lesser roads and culs-de-sac, and using the connecting pathways, are all asking for a share in the artificial sunshine." There has never been such a flood of pleas, requests and demands of this sort since the main thoroughfare of Exeter was first lit by gas.

Although, as I said last month, the student optician is now taught something about lighting, his elders are not all as knowledgeable on the subject as could be wished. One of them, writing on eyestrain in the journal "Metal-working Production," while rightly stressing the over-riding need for adequate illumination, illustrates his article with a photograph showing a toolmaker's lathe provided with an attached local light, the "business part" of which consists of a 150-watt bare internally silvered reflector lamp. It is true, as the caption says, that this provides adequate local illumination, but there appears to be no other lighting, for the background is impenetrably dark and nothing can be seen of the lathe operator except a faint, ghostly head which a spiritualist might be pardoned for supposing to be ectoplasm. And how long is a bare reflector lamp likely to survive in such a situation? The writer of this article also makes the statements that "fluorescent lighting often leads to strain when it is first installed," and "it will often be found that fluorescent light will cause an optical error of the eyes to make itself felt, even though it will have done nothing to increase the error itself." Both of these statements are highly dubious, although both might be more plausible had the writer used the word "occasionally" where he had used "often." But to do him justice, his remarks are not intended as an indictment of fluorescent lighting, for he goes on to say that if persons who have some optical error are properly corrected their complaints will soon cease and then the new lighting will be preferred.

We hear a great deal about death on the roads, but, according to a pamphlet entitled "Dangers in the Home!" 70 per cent. more people meet their deaths "accidentally" in and around their own homes every day than are killed daily on the roads. This is a remarkable state of affairs, and it would seem that a home safety campaign is more urgently needed than a road safety campaign. Falls account for 58 per cent. of accidents in the home, and it would be interesting to know what is the diurnal and seasonal distribution of these accidents. How does the "after dark" rate compare with the daylight rate and the summer rate with the winter rate? Many years ago the Factory Lighting Committee (Home Office) analysed the reported accidents in factories due to persons falling, and found the rate higher during those periods of the day and year when artificial lighting had to be used than when this was unnecessary. This difference in the frequency of falls was one of the pieces of evidence of the need for better artificial lighting in factories. It would not be in the least surprising if it were found that falls in homes occur with undue frequency during artificial lighting periods, for such lighting is poor in many homes and particularly so in parts of the house, such as the stairs, where the risk of falling may be greatest.

Last month I had the opportunity of seeing a demonstration of the B.B.C.'s experimental colour television transmissions. I had expected the coloured pictures at the receiving end to be of rather poor quality, rather like the first coloured cinema films. Instead I was very agreeably surprised at the quality of the pictures. One of the problems of the B.B.C. is to ensure that the eventual colour transmissions can be reproduced as black and white pictures on existing receivers; the majority of the material I saw came out well both in colour and in monochrome. I feel certain that when the B.B.C. does begin a colour TV service it will be of a very high standard.